

# **AKSHAYA VIKAS**

## **SUSTAINABLE DEVELOPMENT**



**VIVEKANANDA KENDRA PRAKASHAN**

# **AKSHAYA VIKAS**

**SUSTAINABLE DEVELOPMENT**



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***T**his book titled **Akshaya Vikas - Sustainable Development** is not only of academic importance but also of great relevance and significance to anyone who feels or understands that life on earth is being increasingly threatened by ever so many factors. Some of them are dealt with in this book. Already great thinkers, scientists and environmentalists have written a lot and have given blueprints for saving the earth and the various species of life from further extinction. Therefore, of necessity, we had to fall back upon the already published expert findings and views on the title mentioned above. It is our bounden duty to acknowledge with a profound sense of gratitude, various publishers from whose relevant books/ periodicals we have reproduced / adapted some portions in order to do a minimum justice to the subject. We give below the list of the publishers:*

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**FOREWORD**

In the last four-five decades, thinkers on development world over, have recognized the importance of Sustainability as a vital component of the discourse.

In spite of the emerging man-made technologies, processes and value additions, the role of Nature in supplying directly the needs of human beings has not diminished. In fact, there is only an increasing awareness of Nature's importance in a world that tended to become artificial at one state.

What is more, there is emerging a new definition of human beings themselves, whose interest and existence are embedded deeply in Nature. This is distinctly a departure from the earlier model of man trying to conquer Nature.

Human beings, as intensely interwoven in the web of all that exists, have to take a greater load of responsibility in preserving Nature and optimally using it. **The spiritual nature of human consciousness has to reflect in all functions of human beings both ecological as well as social.**

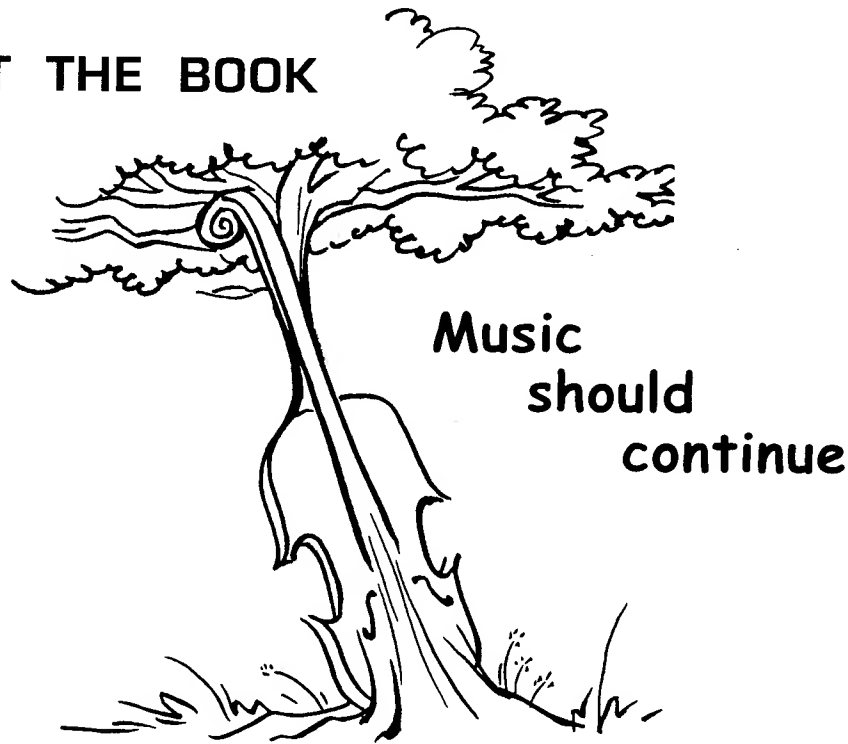
Pollution, over-fertilization over application of pesticides, energy crisis, consumption, human health, atomization of family and community are not isolated problems to be treated a la carte. They need a comprehensive philosophy, appropriate technology, and a set final form.

Vivekananda Kendra's publication **AKSHAYA VIKAS – SUSTAINABLE DEVELOPMENT**, reflects the philosophy of Technology Resource Centre developed by Vivekananda Kendra with CAPART assistance. CAPART, therefore, is happy to be associated with this venture as it gives a bird's-eye view of constraints on development and their possible solutions keeping in view the sustainability of these efforts and basic human needs.

I recommend the publication to the development workers, voluntary organizations, environmentalists and the discriminating general readers.

  
( Rangan Dutta )  
Director General

## ABOUT THE BOOK



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**AKSHAYA VIKAS**  
**SUSTAINABLE DEVELOPMENT**

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### 1) INTRODUCTION

*In the last twentyfive years, some distinct trends have emerged in man's attitude towards Nature. All sane people, who have the welfare of human beings in their hearts have started expressing bluntly some fundamental truths of all existence that (1) Man is a part of Nature; he is not above Nature's laws (2) Feminine values such as Sneha, Prema, Daya and Bhakti are as much part of the laws of existence as innovativeness, courage and entrepreneurship (3) Man should conserve Nature's resources and substitute his use of the stock*

*resources of Nature with the application of renewable resources such as wind, sunlight, biomass, draught animals, the physical energy of human beings etc. (4) The contribution of the South Asia, South America, Africa (where the greatest varieties of living species occur) to human civilization should come in for greater understanding and respect by the world (5) The ecological and the economic roles of community clusters such as family and tribe are very important. Traditional methods and techniques in dealing with Nature are rich with practical wisdom. Using natural resources sparingly and preserving natural variety carefully should be recognized as very important necessities for human survival.*

## **2) THE QUESTION OF ENJOYMENT**

*The process of development has to undergo a paradigm shift almost of spiritual dimensions. The Indian spiritual understanding of happiness as absence of desire for external objects should receive the critical examination it deserves. The human consciousness, the spirit of man is the source of all happiness. Today man is asked to cut down his wants. Without a spiritual basis mere deprivation of sense pleasures will degenerate into stoicism bereft of any sublimating effect on the cruder and external aspects of the human personality. The Indian methods of Tantra, Yoga and Vedanta teach man how to use food (for that matter all inputs received through the senses) optimally, squeezing maximum happiness out of minimum food. It is to the credit of Rudolf Ballentine, the nutrition scientist, who wrote in a Western idiom that it is mind and not necessarily food that has to do much with nutrition. This basic truth can help humanity to give up or reduce its unnecessary dependence on external material objects as inputs for its survival, happiness, efficiency and growth.*

## **3) THE LIVING WORLD**

*From the Vedic times onwards, India has treated man as a part of Nature, sharing his destiny with it. Therefore all that exists, the entire creation is sacred, the living beings are more so. The Indian attitude towards life has been defined by this basic and axiomatic truth, and all technicalities and details of life are founded on this truth, the truth of inter-connectedness of all that exists especially the organic world.*

*The dwindling number of living species in the world is an urgent concern in development. Man has to protect them. Man today has measured a physical world, a cosmos 12 billion light years across, crowded by countless planets, suns and stars. But he knows only one earth where "life" - "an offensive against the repetitive mechanism of the universe" (A.N. Whitehead) exists for sure. A Nobel Laureate once said that soon machines will take away all the work man is doing today. To do any work for the first time, the creative brain of a human being is required. To do the same job a second time, third time, a machine will do it better, without getting tired. This creativity, compassion towards other living beings and moral sense, are the three uniquely held values of man. Empathy with other living things and non-repetitive awareness are the traits of fauna and flora. This uniqueness is very rare in the entire cosmic world. The value of Ahimsa, nonviolence or respect for life practised by a large number of Indians as a part of their religious and spiritual culture, can help mankind protect bio-diversity, save living plants, animals and other organisms. In fact, UNICEF talks of promoting vegetarianism as one of the possible methods of solving the food problems of the world, the ensuing pressure on agricultural land and the dwindling per capita cropland in the world.*

*Treating livestock and agriculture as integral parts of a single whole is strongly advocated as an effective measure in sustainable development. The present system of chemical fertilizers and pesticides as inputs in agriculture and pollution and waste disposal as the end-of-the-line problems have set man athinking. Scientists have seen sense in closed systems/ integrated farming processes where agricultural residues are consumed by the livestock and livestock wastes can be composted for use as manure. The spirit of closing this loop thus instead of making it an open line has uses beyond the frontiers of agriculture. It is the spirit behind Gram Swaraj, (a self-sustained village) regional self-sufficiency and the ideal of Swadeshi, a Nation having the courage of being itself keeping its identity instead of aping others. For the entire art, science and culture of preservation of livestock and flora, - forests form the sustaining base by providing for grazing, preserving bio-diversity, controlling climate and purifying air.*

#### **4) THE WATER OF LIFE**

*Traditional wisdom of India says that man's attitude towards his material economy will be defined by his attitude towards water, the most essential component even of his physical body. Human civilizations founded on the banks of rivers, have risen or fallen with their water wealth. Communities have revolved around water bodies. People have been knitted into neighbourhoods, villages, communities, and Nations by working on rivers and canals, lakes and ponds, desilting them, defining them and repairing them. Man is linked to man through them. In the Tamil tradition even Lord Shiva had to do some physical work, preserving the bunding on the riverbank, when he came down to Madurai in human form. Even Gods are not exempted from the community work of preserving water-ways and water-bodies. Or repairing the bund of a river is God's work. When a citizen undertakes this work he is in the company of God. That is the tradition.*

*When the Tarun Bharat Sangh of Alwar (Rajasthan) revives dead rivers, or when villagers in Maharashtra create a water community (Pani Panchayat), they show us how to use water as a community "common". They are not conserving water. They are rebuilding communities too.*

*But when Governments and Banks encourage paid workers to substitute the voluntary labourers in villages in the task of upkeep of ponds and lakes, they not only practise bad economics, they practise bad sociology too, making future disengagement of Governments from developmental processes impossible. People will lean more and more on Governments allowing their community bondings to atrophy.*

#### **5) BURNING UP OUR FUTURE?**

*Burning up irreplaceable fossil fuels, polluting the atmosphere, gnawing away the ozone layer, meddling with both the earth's climate and the predictability of its monsoons are not inevitable.*

*Renewable energy sources based on solar and wind energies, biomass etc. can be made commercially viable and environmentally safe and sustainable. It is*

*heartening to note that already some industrial managers and investors have started evaluating the environmental and social sustainability of projects before sinking their money into them. There are others who have already stretched their vision long enough to make their industrial ventures viable not only economically but environmentally as well.*

*As research in capturing solar and wind energies and in storing and transmitting them progresses, cheaper generation and loss-free transmission technologies will certainly be evolved. The present energy sources will then lose their dubious distinction of being the most polluting aspect of all human endeavours. That solar and wind energies that lend themselves to highly decentralised generation will have great impact on man's life in spheres far beyond mere savings on energy transmission. Decentralisation and empowerment will pervade all aspects of the life of the community.*

#### **6) THE SPIRIT OF ONE UNDERLYING THE MANY APPEARANCES**

*Preserving the bio-diversity and protecting the diverse habits and cultures and methods of worship as opposed to the monoculture of the mind, are in accordance with the ancient Vedic and Gita's wisdom. The Vedic rishi, not put off by the apparent diversity in the external world, delved deep into the spirit of things and identified the underlying unity. Approaching this unity in one's life, is the spiritual Sadhana. Respecting the variety and striving to preserve it are the real Karma Yoga. Marching from diverse externals to spiritual unity of course is a change, where nothing changes except one's perception. Nothing gets lost except the perceiver's petty ego.*

#### **7) SANCTUARIES**

*All theories of environmental and social sustainability will be of no avail unless working models are created and presented to humanity. Individual ventures, case histories, and men and women of conviction demonstrate to the world that mankind may still beat the odds of environmental disasters and manage to survive. Gandhi and Schumacher have succeeded in reviving man's hopes in himself. Capra has given us a modern scientific discourse of*



*sustainability. The ultramodern science, ancient wisdom, and the world's truthful and compassionate thinkers have pooled their energies to present us with a paradigm of sustainability. It simply says that the most useful, the most beautiful, the most economic, self-sustaining truth is also the most ethical and economic wisdom. Correct economics, simple aesthetics and sincere spirituality are but different names of one TRUTH.*

#### **8) SMALL IS BEAUTIFUL; WILL BIG ALSO BE BEAUTIFUL?**

*While creating systems that are socially and environmentally sustainable, the human tendency has so far been to come up with small units which human hands and mind can reach and encompass easily and effectively. This approach has won global approval among ecologists.*

*Cottage and intermediate technologies are encouraged. Small irrigation projects are commended. Big dams are frowned upon. There is no doubt-Small is beautiful.*

*Each such small developmental unit also doubles as a small human society. Mankind should come up with larger conglomerates, so that the awareness gained in the smaller field could be used elsewhere in the larger fields of Regional co-operation, Nation building and International coordination.*

*In the last couple of centuries, man-made ideologies have collided with natural institutions such as families, communities and traditions. In the clashes that ensued, man-made theories, ideologies, parties, states and governments have lost the battle to naturally evolving families, cultures and in some cases, religions. Looking at this scene, some people have started wondering whether man will regress towards his pastoral past. Some others felt that man has committed the greatest blunder of his existence in launching "Civilization", agricultural, industrial and scientific. To them they were all "unnatural". Some scholars want to forget the entire era of scientific industrial activities as bad dreams and start all over again from where man left off five hundred years ago. Others put the beginning of the bad dreams at 8000 BC when agricultural civilization started.*

*If man can learn to build large systems without losing the Naturalness of the small units, a large order of National or international size can become a reality. Sri Aurobindo talks of a "political" conglomeration of naturally evolved groups - to form a state. Ecologically too, smaller, beautiful groups, units and systems should coalesce to form larger units. But this coalescence should be based on the spiritual laws according to which man has been created and Nature's systems are built, the laws which talk of the interrelatedness of all that exists, the divinity of the existence as a total and the immortality of the human soul. Man and his small ecological units will have to grow according to these laws, or lose the track and go astray. Man need not shrink into his small ecological niches being afraid of largeness. He will be in no danger as long as he keeps within the bounds of these basic spiritual laws. Then big also will be beautiful, as beautiful as the skies, the mountains and the oceans. Man's individual growth as opposed to Nature's laws is what Sri Aurobindo calls ego. Sooner or later this man will have to retrace his steps from the paths of ego-powered progression. The solution to the problem is not to get stuck with small units. The answer lies in tracing the thread of growth and build large system states and empires, empires both of mind and matter.*

## **9) TIME (KALA) AS A FACTOR IN DEVELOPMENT**

*The role of time in sustainable development is being understood more and more now. Nature takes its own time to purify air, degrade waste, digest materials and recycle them. Modern science in its "wisdom" to equate development with speed has rejected as waste and pollution much of what in due course could have been absorbed back into Nature's womb. In an integrated environmental awareness and spiritual consciousness, every action will be completed and come into fruition, as soon as the performer's ego is erased and the performer acts spontaneously without any inhibition. This kind of action which does not inhibit the actor is called "Akarma" in Karma Yoga. Nature too acts in spontaneity when it is not meddled with by the egoistic man. That is why great saints could live without disturbing Nature. They stayed within the bounds of Nature's laws harmonising with Nature's rhythms. Patience is a spiritual virtue, an ecological factor, an input in sustainable development.*

*Gandhiji too in his "Hind Swaraj" frowned upon modern science for giving undue importance to speed, blunting human sensibility.*

*All attempts to speed up nature's processes, especially of elimination and digestion of waste, have only complicated matters. The only way out is for man to understand nature's laws and act accordingly in an egoless manner. In Nature's perception, nothing is a waste. Everything has its genuine role to play in Nature's performance. What man cannot understand, is called waste by him. This is a highly subjective view. The proponents of Sustainable Development learn to apply time as a resource or rather patience as a resource.*

#### **10) SHOULD WE CRY HALT TO DEVELOPMENT?**

*Developmental processes, which have gone astray have become the butts of innumerable jokes by ecologists. But human efforts cannot be stopped. Man cannot just sit idle watching Nature taking its own course. It is Andrei Sakharov the Russian pacifist, who said that man would not be able to walk his way back to his pastoral and ecological innocence. But that does not mean that man has to persist with his ecologically destructive developmental technology. Man has to understand the spiritual laws of nature and focus all his scientific energies into simplifying technology, simplifying life, getting the clutter off his onward path. Spiritually inspired science will take man to his natural inborn simplicity - soulfulness and spontaneity. He shall then "walk in beauty" with Nature and not run in madness against it.*

#### **11) CONCLUSION**

*Ultimately it should be said that Sustainable Development is a learning process and is not a mere end point. Necessarily, different sections of the society will move at varying speeds. A few will find spiritual substitutes for voluntarily accepted physical deprivations. A few others will derive strength from the feelings of solidarity with the community while making material sacrifices.*

*A few others with hard economic sense in long-term considerations will motivate others to make the developmental processes and techniques*

*Sustainable. The laws of the lands and punitive methods will not be spared in bringing others to fall in line in protecting the environment. Man then will either learn to live with Swans or resign to die with Ostriches.*

*Before we enter the book, it should be made clear that this book does not claim to have dealt with all the aspects of Sustainable Development. This volume covers (1) the philosophy and general theory, (2) food, diet, nutrition and food security, (3) modernization of agriculture, (4) water, flood, dams, tanks and groundwater, and (5) harmonizing biodiversity conservation and agricultural development. The other important issues such as Health and Energy, Habitat, Employment etc. have not been covered.*

*This book originally appeared as an issue of **Vivekananda Kendra Patrika**, our half-yearly journal (Vol. 29 No.2). The heavy demand for the material published therein, necessitated the present publication. □*

## **PHILOSOPHY AND GENERAL THEORY**



**Ostrich** : Increased production!  
Increased wealth! Greater  
enjoyment! India like America! Scientific  
solution to all the problems! Science is the  
panacea! Science! More science!

**Swan** : Mass based production!  
Reduced personal possession! Enjoyment  
not dependent upon external objects. India  
like India. Science with Philosophy,  
Wisdom, Peace! Compassion! Creativity!

**Parrot** : Balance! Balance!  
Balance! Ecology with economics.

Balance American science with Indian  
philosophy.

**Swan** : Ecology cannot be balanced  
by economics. If man has to survive, he has  
to survive along with all other living species,  
plants and animals. Already man has  
destroyed too much of his environment for  
the sake of his stupid ideas of economic  
development. Any more economic progress  
has to come by man's ingenuity,  
compassion, capacity to share the existing  
wealth. Tapping human goodness,  
resourcefulness, spiritual wealth, capacity

to manage with less material wealth is going to be the real economics of ecology.

**Ostrich:** What about my dreams of making India like another America ?

**Swan :** India is never going to be an America. Each American takes away the share of 16 others of the world kitty. India does not want to exploit 1600 crores of people of the world for its own survival.

**Parrot:** OK. Let us compromise. Strike an average.

**Swan :** You cannot strike a balance between good and bad. The model we are talking about is based on value system where man draws energy from within! A relaxed man, a healthy man, an efficient man, a satisfied man, a wise man, an intelligent man, an ethical man, needs very few things from outside for his survival, happiness and self-expression. The ultimate resource is a wise man: acting as a part of his community, behaving like a strand in the web of life, a star in the firmament of all existence.



## PARADIGMS OF SUSTAINABILITY

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S.R. RAMASWAMY

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**T**he simultaneous presence of natural-resource-richness and poverty in the same region after four decades of planning itself demonstrates the inadequacy of the strategies of development pursued so far.

Mountains of apples rot every year in Himachal Pradesh and Kashmir, while people down south have to pay astronomical prices for apples. Is transportation such an insurmountable problem? The same system has no problem in airlifting roses and gladioli from Chandigarh to florists of distant Europe.

On the one hand we see hunger and poverty increasing. On the other hand we see that agricultural exports increased from Rs. 3,672.8 crore in 1988-89 to Rs. 6,345.5 in 1990-91.

### WRONG PRIORITIES

Sometimes exotic vocabulary will be used to circumvent the real issues. Thus, recently the 'Biodiversity' Treaty has been in the news. But what is actually being discussed in international conferences is not

genetic diversity, variations within species or interdependence of species, but technological aspects such as benefit-sharing, investment in new technologies, etc. Most scientific activity now in progress is directly linked to commercial exploitation of genetic resources.

To transfer environmental issues to the realm of technology is a classical device for evading and de-focusing the real issues. For instance, what needs to be discussed about the Sardar Sarovar Dam basically is not the height or submergence or displacement, but whom the dam benefits eventually. If it should transpire that the biggest beneficiaries will be the tobacco-growers of Kheda region of Rajasthan, then the dam will have to be opposed even on non-environmental grounds.

What is being challenged through the anti-Narmada agitation is not that specific project but the dominant model of development itself. Environmental issues, so called, are essentially questions of equity. The consumption level of the top 20% is 150 times that of the bottom-most 20% of

the people. To talk about impending deaths fifty years from now is a successful way of avoiding discussion of deaths taking place this minute in our neighbourhood.

We express shock at the killing sprees of terrorists in Kashmir or Punjab. But how many of us are aware that the



greatest benefactors of agriculture - namely the noble frogs which rid the fields of harmful insects - are merrily butchered every day by the thousands? Does it shock our conscience that some two crore bullfrogs are killed in a year in the name of scientific education in VIII standard anatomy classes?

While international summits discuss technological outlays, some 30,000 species of micro-organisms are being lost each year.

Some 30,000 known species of plants in the tropical regions remain to be adequately researched.

That our ignorance about these life-systems far outweighs our knowledge is being demonstrated every day. The hybrid dwarf wheat promoted under the Green Revolution is now losing the battle against weeds which have developed resistance to Isoproturon, a widely used herbicide.



Obsession with gigantic projects has been the bane of post-Independence planning in Bharat and elsewhere. Even the single prop it used to have - namely the 'economy of scale' - has come under increasing questioning. Mega-projects have so far gobbled up some 180 million

hectares of prime land, and each day is witnessing the diversion of more and more land for non-food use.

### LIMITS OF SCIENTISM

It would be futile to hope that economists or technologists will some day be able to predict safe level of resource exploitation. In any case, greed overtakes reasonableness. Scientific calculations have no relation to the course of events. Reliance on so-called scientific analysis has often produced disasters of epic dimensions. Based on 'scientific' estimates of fish population, the Canadians established a huge fishery enterprise. The estimate was so far off the mark that several thousand persons have now been thrown out of jobs.

Overestimate of harvest is common in the logging industry. Sustainability is not a lasting or steady-state condition. Science and technology as now developed have no expertise of dealing with such 'moving targets'. Any natural resource needs to be studied only within the framework of unavoidable human interventions.

Resource problems are basically not environmental problems at all; they are really human problems which are a consequence of diverse factors - socio-political as well as cultural.

Anything simple and cheap has no interest for us; anything complex, gigantic and expensive carries great attraction.

A solar cooker had been constructed as far back as in the Nehru years. To this day that device has not made it to our homes, despite the fact that we have ample sunshine during most of the year.

Four decades of experience have proved the irrationality of according priority to pulp-based, timber and plywood industries over local needs of the people; and yet the present Environment and Forest Ministry has planned to transfer so-called degraded forest areas to industries, while some 400 million people depend entirely on forests and minor forest produce for their livelihood.

In such a background of skewed priorities, one is not surprised that a comparatively resource-endowed region the Kalahandi has become a classic textbook case of underdevelopment. Nor is one surprised that a resource-rich State like Kashmir has to import livestock from the desert State of Rajasthan.

In the sense in which technocrats now view the matter, exploitation of resources has never been 'rational' or sustainable. But available evidence indicates that coping mechanisms were better in the earlier periods than at present,

that environmental sustainability, equitable distribution and efficiency of resource-use were better reconciled in the past.

### THE CULPRITS

It is now proved beyond question that the industrialised world has been the major culprit in causing ozone depletion, due to carbon emission. Between 1950 and 1987, the U.S.A. alone has released as much as 40 billion tonnes of carbon into the atmosphere; the whole of Europe—about 23 billion tonnes; U.S.S.R. - 23 billion tonnes. What Bharat has managed is a mere 3 billion tonnes.



"NOW, A WORD OR TWO  
ABOUT THE ENVIRONMENT"

In such a background, the West's eagerness to discipline the Third World countries and pontificate to them on preservation of forests, etc., is comical.

Incidentally, the state of the environment is not unrelated to defence expenditure. Out of the total, 25% of jet fuel is used by defence establishments of the world, accounting for 10% of carbon emissions which affect the ozone layer.

Today, global expenditure on arms and armies is of the order of \$815 billion (Rs. 25.71 lakh crore). A fraction of this amount could do much to restore the world's physical environment.

None of these facts is unknown to governments. It is just that they prefer to cocoon themselves under the wrap of what may be called the Collective Dream - no matter if it is fast turning into a nightmare.

Each decade sees the emergence of a new developmental vocabulary. 'Sustainable development' and 'sustainable agriculture' are the current favourites.

Thus, the most recent policy document of the Food and Agriculture Organisation (*World Agriculture: Towards 2000*) claims to provide a 'transition to sustainable agriculture'. One wonders what is 'sustainable' in a set of formulations which have themselves led country after country into more poverty and hunger. For instance, even at this late hour, FAO continues to endorse the proliferation of crops requiring chemical fertilisers and chemical pesticides.

The future survival of mankind can be ensured only by encouraging (i) diversity of crops, (ii) protecting genetic diversity, (iii) avoidance of chemical pesticides, (iv) control of agricultural inputs, (v) encouraging subsistence agriculture, (vi) promoting trading patterns conducive to local self-reliance, and so on. But international agencies continue to promote high-external-input agriculture, and also continue to commoditise and globalise agriculture through enormous support to export-marketing and raising of cash-crops. The same scenario prevails in the forestry sector. The Debt Trap into which 'Third World' countries have been sucked has ensured submission of native governments to the dictates of international and multilateral agencies.

### PRODUCTIVITY

In chemical agriculture, after the initial increase in production, there will be steady decline in productivity, so that external inputs will go on increasing even to reach the earlier level of production. A number of studies by the Indian Agricultural Research Institute have established the NPK - dependent intensive farming leads to a declining trend in agricultural productivity.

For example: In the Terai region of Nainital in Uttar Pradesh, the productivity

of land, which was around 12 tonnes per hectare in the 1970s has now slumped to 2.2 tonnes per hectare. Similar is the experience in Punjab.

The Green Revolution package has been promoted on the basis of the 'ardha-satya' (half-truth) that chemical manures alone increase productivity.

Historical data belies this supposition.

*The Cambridge Economic History of India* mentions that the South Arcot district of South India produced (around 1800) about 33 quintals of paddy per hectare, while the more fertile Ramnad district produced as much as 66 quintals per hectare.

That similar high productivity prevailed in other parts of the country is confirmed by the records left by Francis Buchanan and others.

Obviously, such high productivity was due to sound agricultural practices rather than mere fertility of soil or mere external inputs. While in the past high productivity was achieved simultaneously with care for the health of the soil, at present, the health of the soil is being sacrificed to achieve only a marginal and short-term increase in productivity through monocropping, chemical fertilisation and the use of chemical pesticides.

Obviously, chemical-based agriculture has now reached its limits. Progressive farmers in many parts of the world are giving up chemical farming and returning to traditional organic agriculture.

*"The 1990s are the beginning of the end of the Chemical era"*

- says Dave Dyer, director of the American Farmland Trust. Presently the U.S. Department of Agriculture's Low Input Sustainable Agriculture division is funding over 78 research projects relating to natural farming.

This proves that traditional approaches were sound and farsighted, after all.

### **REDUCTIONISM**

Given the history of Western Europe's colonisation in earlier centuries and the modern-day colonialism in the shape of global market mechanisms, it was not surprising that the U.S. opposed the Biodiversity Treaty, arguing that economic growth of the U.S. cannot be jeopardised for the sake of environmental conservation. As repeated often, the U.S.A., with a mere 5% of the world population, consumes some 46% of the entire planet's resources. It is this pattern of economy which the U.S. would like to preserve and perpetuate. That this is

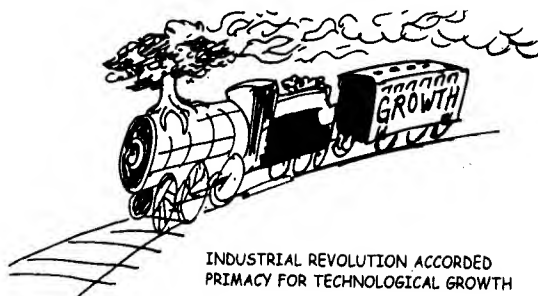
becoming increasingly difficult of sustenance for the U.S.A. itself is another matter.

What is relevant to us is the philosophy behind it. The present philosophy of growth emerged conjointly with the expansion of the West. The basic premise was that unhindered growth is possible, and this was extrapolated into an apparently limitless future. Briefly, the following stages are traceable in the West's world-view:

1. The Inductive Method commended by Francis Bacon (1561-1626).
2. The supposition - e.g., by Descartes (1596-1650) and Isaac Newton (1642-1727) - that the whole universe is amenable to comprehension through reductionism and quantification, and is therefore predictable and manoeuvrable.
3. Separation of facts from values.
4. Propagation of the thesis that marrying technology with science enables the harnessing of natural resources for meeting human needs.
5. The so-called Industrial Revolution which accorded primacy to technological growth.



6. Projection of satisfaction of physical wants as civilisational progress.



7. Replacement of needs by wants.
8. Evolution and entrenchment of an over-consumerist society.

Bacon's and Descartes's refinement of the method of acquiring objective knowledge was admirable and released the European mind from the tyranny of the Church. This set in trail the vehicle of materialist progress of the West.

What proved to be a blessing for mankind in the seventeenth century later became the cause of regress of civilisation. What Bacon and Descartes propounded is separation of facts from bias. But this process went on and ended up in the separation of facts from values.

Thus, value-freeness provided the justification for destruction-oriented pursuits.

The next stage was subverting the method of science itself. The sum-total of studies of parts came to be equated with whole knowledge. Later, some allowance was made for synergism. But the engine had already started on the wrong track.

A corollary was that the natural resource system began to be looked upon as inert, separate and unconnected entities rather than as living organisms; and quantification became the new Bible. In the next three hundred years, the singlemost obsessive preoccupation of science was fitting knowledge into mathematical equations. All research became thus tool-dependent. The importance of even observation of surroundings came to be devalued.

A natural consequence was:

1. Concentrating on only those aspects which are amenable to quantification.
2. Avoidance of objects and levels which are subject to complex interacting forces which defy quantification.

As a result, science failed to interrelate parts of nature holistically.

The limitation of such reductionism was expressed by a highly respected scientist Albert Szent-Gyorgyi :

## VISIONARIES



Old lamps for new

Critics assert that a simple lifestyle is joyless, that those who propose this want to stop people having fun. If those who make the loudest and most joyful noises had produced a happy society, there would not be the levels of violence, fear and addiction that disfigure the rich world.

As soon as any mention is made of cutting down consumption, the monopolists of the necessities of the impoverished discover a sudden tenderness for the have-nots. When they virtuously proclaim the right of the pauperised to attain the living standards of the rich, they are rarely talking about redistribution. Under the cloak of convenience, they are really pleading for their own uninterrupted enrichment, beyond satiation.

Yet even the apologists of injustice ("You want to bring everybody down to the same low level") - who virtuously proclaim their desire to level every one up - are discovering as they peer into the future that the exploitation of people and planet threatens their own well-being: there is simply nowhere to hide from the

consequences of their actions, no island on earth sufficiently secluded, no refuge from the contaminants and pollutants they have unleashed in the world.

It is claimed that those who advocate a simple lifestyle are "turning the clock back". But the real turners back of the clock are those defending present patterns of "progress" and "development" which are already leading to violent conflict, from the Bombay slums to the Narmada project, from uranium mining in Australia to the Amazonian rainforests. Hyperconsumption by the rich is modifying the climate, which will drag and drive us back to the climatic conditions of thousands of years ago. Such a state, which could be unimaginably harsh. When "the earth is void and empty and darkness is upon the face of the deep" once more, who will then have been the agents of turning back the clock?

One of the abilities that is supposed to have accelerated human evolutionary progress is the capacity to think about the future and act accordingly. This capacity appears to have degenerated and atrophied in the false prophets of an endless prospect of painless plenty. To leave the future of the human race in the hands of such visionaries may mean annihilation for all of us.

**- Winin Pereira and Jeremy Seabrook.**

*"It made my life a wild-goose chase... For twenty years I worked on the molecular level. These studies netted me a Nobel Prize.. but left me without a better understanding. The more I knew, the less I understood. I feared that I would end my life knowing everything and understanding nothing."*

## FRUITS OF TECHNOLOGY

When we analyse what technology and the technology-based model of growth have delivered, we will have to conclude that recent 'progress' is in fact retrogression.

*Consider the following facts:*

1. 95% of the world's food supply now comes from just 30 species of plants.
2. 3 of those species-rice, corn and wheat-account for more than 50% of the cultivated cropland in the entire world.
3. Just four varieties now account for 72% of America's potato production.
4. The entire soyabean crop in America is derived from a mere 6 plant-species originating in Asia.

The Green Revolution which has been aggressively promoted since the 1960s has

resulted in farmers' abandoning their time-tested sturdy seed varieties in favour of commercial hybrids which are sterile and non-replicable. The so-called Green Revolution package was a handiwork of profit-oriented companies of the West. Frightened by the dimensions of the monster it has itself raised, the U.S. now desperately keeps a few hundred seed-species in a maximum-security bank in Fort-Collins, Colorado.

Philosophically, the use of pesticides is revolting.



Should we not think of our place in creation? What right do we have to kill the bacteria? In fact, they are the original inhabitants, and we are the intruders. Should we not learn to live in harmony with them instead of resorting to violence and degrading our souls in the bargain?

Many decades ago, Albert Howard showed through intensive experiments in Northern India that pests attack only weak and sick plants. Use of pesticides encourages the evolution and proliferation of more hardy varieties of insects.

The basic fact is that the Nature is unique and non-replicable and should be preserved at all cost.

Even on merely physical reckoning, trees are of enormous value if retained as trees, instead of being felled. If we compute oxygen manufacture, water conservation, prevention of erosion, etc., an average tree over a 50 years life-span is worth Rs. 15.5 lakh, according to the calculations made by Dr. Tarak Mohan Das of Calcutta University.

### HOW MUCH DO WE KNOW?

To respect and practise harmony is a divine quality. The law of harmony is a divine gift. Man can survive and prosper only if he obeys the Eternal Laws which we call 'Dharma'.

It may be worthwhile to recall what the French thinker Voltaire said in *Ignorant Philosopher*:



AS VOLTAIRE SAID:  
"IT WOULD BE VERY SINGULAR  
THAT ALL NATURE OBEYS  
ETERNAL LAWS BUT A FIVE-  
FEET HIGH ANIMAL, IN CON-  
TEMPT OF THESE LAWS COULD  
ACT AS HE PLEASED --  
ACCORDING TO HIS CAPRICE..."

*"It would be very singular that all nature, all planets, should obey eternal*

*laws, and that there should be a little animal, five feet high, who, in contempt of these laws, could act as he pleased, solely according to his caprice."*

If one pondered over how little one knows about micro-organisms, one would think twice before poisoning one's field with all those meaningless chemicals. One acre of a pasture in England was calculated to contain 71 million beetle-individuals, 249 million spring-tails, 666 million mites, 135 million assorted aphids, bristle-tails and other miscellaneous arthropods. Their population would be much more in our tropical evergreen forests and virgin croplands. A hectare of temperate grassland would contain fungi weighing 4,000 kg and bacteria weighing 3,000 kg, in addition to hundreds of kg of annelids, arthropods, protozoa, algae and nematodes.

Billions of dollars are spent over space programmes. But out of some 1.5 million fungi, hardly 69,000 have so far been documented. Out of over 300,000 bacteria and viruses, only about 14,000 have been named. Out of about one million nematodes known to exist, only 12,000 have been identified. Likewise, we have knowledge of hardly 30,000 mites, whereas they number over a million. An area no bigger than a hockey court at the bottom of the oceans was found to contain 90,677 small invertebrates belonging to some 171 families

feeding on sediments - a richness rarely matched on earth's outer surface.

It is the demonic or Asuric tendency which mocks at the Law of Harmony. It is the nature of Asuras to be given to insatiable desire, arrogance, hypocrisy, conceit. It is these qualities which have dominated the industrialised West.

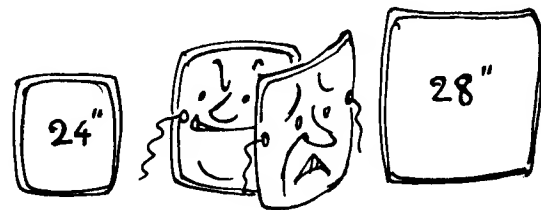
## THE CONSUMPTION RACE

According to the dominant world-view, Nature is a resource meant for satisfaction of man's needs. Progress being equated with material consumption, any theory or viewpoint arguing for less consumption is regarded as anti-progress and as leading to human misery and civilisational stagnation.

An average American consumes in a single day 18 kg of petroleum and coal products, 13 kg of minerals, 12 kg of agricultural products and 9 kg of forest produce. This includes beef from ranches which have replaced rich Amazonian rainforests. Compare this with the life-style of a quarter of humanity inhabiting Bharat, Bangladesh and sub-Saharan Africa who consume no minerals or petroleum but survive on the direct use of biomass available in their surroundings.

The tendency to overconsume has its roots in the mental frame. As expressed by

an Australian farmer, happiness is a 26-inch TV screen while the neighbours have only 24-inch screens; and misery is having a 26-inch screen TV while the neighbours have 28-inch screens. Such a continuous and frantic race ensures permanent unhappiness for all the dramatis personae.



An unfortunate corollary to this development is that complex and high-cost researches attract the lion's share of funding; inexpensive subjects of research are neglected and looked upon with contempt.

Even the most recent forays of the West in the direction of ecological stability ("Sustainable Development", to use the latest fashionable vocabulary) are derived from practical necessity and from the impossibility of sustaining the industrial-technological approach to life. This is obviously an exercise in futility.

## BHARAT'S LEGACY

For any system to work successfully, the philosophical basis has to be sound.

Bharat has an ancient and continuous tradition of respecting Nature. Love of nature

has indeed been central to our entire cultural heritage. For instance, all our major festivals are season-related. The greatest works in our lore - the Vedas, the *Ramayana* and the *Mahabharata*, the works of Kalidasa - are replete with descriptions of Nature in all its magnificence. Oneness with Nature is, in our tradition, not a strategy of convenience but a basic faith and axiom.



EPICS DESCRIBE NATURE IN ALL ITS GLORY

One other feature of our civilisation deserves special notice. It was realised that, in addition to appealing to philosophical sensitivity, practical measures would also be needed to ensure preservation of the wealth and diversity of Nature. Thus, worship of different species of trees was prescribed for different rituals: the banyan tree for rituals connected with child-birth; the fig tree (Ashwattha) for worship of the sun; the Kimshuka (*Butea frondosa*) for the Shravani festival; the Udumbara for worship of Prajapati; and so on. By prescribing such

different species for different occasions, they ensured that varieties of trees were grown in the vicinity of each settlement.

It hardly needs explanation that when conservation is integrated with life, it has a much better prospect of succeeding than if tackled on an ad-hoc basis.

Yet another aspect which we should take note of is that these conservationist measures were enforced when Nature had not been denuded as in later times but was still rich and less exploited. This indicates far-sightedness.

The Smritis prescribe severe punishment for reckless cutting of trees.

The *Matsyapurana* goes a step further and says that even a servant cutting a tree at his master's behest is not exempt from punishment. The punishment is made more rigorous for cutting trees in the catchment of tanks and on the roadsides.



PEOPLE WORSHIP TREES

The *Agnipurana* celebrates the planting of trees as the noblest of meritorious deeds.

“*Yajna-shishtamrita-bhujah*”-says the *Bhagavad-Gita*. What we are entitled to consume is what remains after offering sacrifice, i.e., after fulfilling Nature’s obligation.

With what reverence our sages looked upon Nature can be inferred from an incident of our own times.

Once a devotee came for the darshan of Bhagavan Ramana Maharshi. On the way he saw a plant full of flowers. He thought of taking and offering the flower as a token of respect to Bhagavan. So he carried a couple of flowers, placed them at the feet of Bhagavan and made obeisance.

Bhagavan, on seeing it, became sad. He asked the devotee:

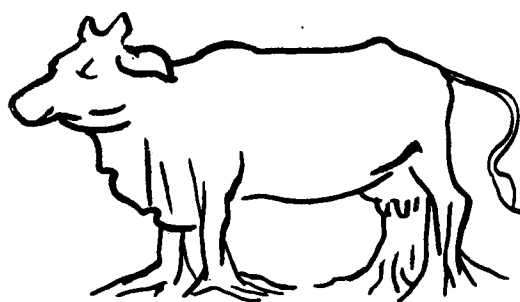
“Where did you bring it from?”

“I saw it in a plant on my way, and felt like bringing and offering it here.”  
*Bhagavan replied :*

“Where was the need for separating the flower from the plant and bringing it all the way here? And in any case, of what use is it to me? Instead, if the flowers had remained on the plant itself, scores of

people passing on the road would have seen and enjoyed its beauty.”

What is needed is not an ad-hoc response to the havoc wrought by industrialism but a holistic approach to life itself. Even the so-called ecological movements of the West are at best exercises in damage-limitation. The only durable solution can come from recognition of oneness of all life. What is demanded is that man should not destroy Nature. While the West talks of ‘exploiting’ Nature, Hinduism advises man to ‘milk’ Nature. When one milks a cow, it does not kill the cow but at the same time meets one’s need.



In fact, Nature worship was but an extension of the integral view of life which dictated - “Nourish Nature and take from it only as much as is needed to sustain life.” Clearly, this is not total abstention, but living a good life in tune with Nature. This is sustainability in the broadest sense.

**Source : *In the Woods of Globalisation, Sahitya Sindhu Prakashana, Bangalore, 1995.***

## THE CHALLENGE

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FRITJOF CAPRA

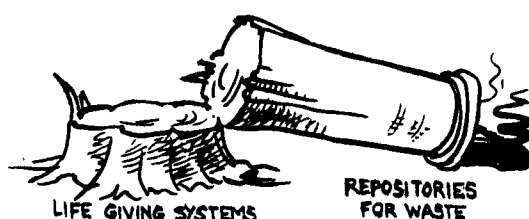
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As the century draws to a close, environmental concerns have become of paramount importance. The survival of humanity and of the planet are at stake. Concern about the environment is no longer one of many “single issues”; it is the *context* of everything else - of our lives, our business, our politics.

Today we are faced with a whole series of global problems which are harming the biosphere and human life in alarming ways that may soon become irreversible. We have ample documentation about the extent and significance of these problems. One of the best recent accounts is the book *The Ecology of Commerce* by Paul Hawken, which discusses the central role of business in global environmental destruction and, at the same time, the unique opportunity for business to become the driving force of ecological restoration. After a thorough review of the series of ecological catastrophes we face, Hawken reaches a devastating conclusion :

Quite simply, our business practices are destroying life on earth. Given current

corporate practices, not one wildlife reserve, wilderness, or indigenous culture will survive the global market economy. We know that every living natural system on the



planet is disintegrating before our eyes. The land, water, air and sea have been functionally transformed from life-giving systems into repositories for waste. There is no polite way to say that business is ravaging the world.

The great challenge of our time is to create sustainable forms of business, embedded in sustainable communities. Lester Brown of the Worldwatch Institute, who has been one of the main advocates of ecological sustainability for many years, defines a sustainable society as one that is able to satisfy its needs without diminishing the chances of future generations.



How can we deal with this tremendous challenge? Where do we start?

### **CRISIS OF PERCEPTION**

The more we study the major problems of our time, the more we come to realize that they cannot be understood in isolation. They are systemic problems - interconnected and interdependent. Stabilizing world population will only be possible when poverty is reduced world-wide. The extinction of animal and plant species on a massive scale will continue as long as the South is burdened by massive debts. Only if we stop the international arms trade will we have the resources to prevent the many destructive impacts on the biosphere and on human life.

In fact, the more we study the situation, the more we realize that, ultimately, these problems are just different facets of one single crisis, which is essentially a crisis of perception. It derives from the fact that most of us, and especially our large social institutions, subscribe to the concepts of an outdated world view, a perception of reality inadequate for dealing with our overpopulated, globally interconnected world.

At the same time, researchers at the leading edge of science, various social

movements, and numerous alternative networks are developing a new vision of reality that will form the basis of our future technologies, economic systems, and social institutions. So we are at the beginning of a fundamental change of world view in science and society, a change of "paradigms" as radical as the Copernican Revolution.

The paradigm that is now receding has dominated Western industrial culture for several hundred years, during which it has shaped modern society and has significantly influenced all parts of the world. This paradigm consists of a number of ideas and values, among them the view of the universe as a mechanical system composed of elementary building blocks, the view of the human body as a machine, the view of life in society as a competitive struggle for existence, the belief in unlimited material progress to be achieved through economic and technological growth, and - last, not least - the belief that a society in which the female is everywhere subsumed under the male is one that follows a basic law of nature. All of these assumptions have been fatefully challenged by recent events. And, indeed, a radical revision of them is now occurring.

### **DEEP ECOLOGY**

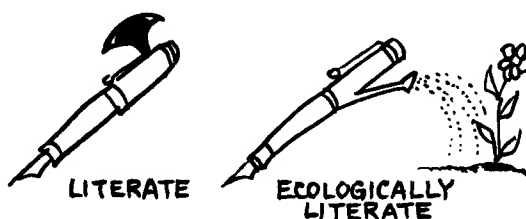
The new paradigm may be called a holistic world view, seeing the world as an

integrated whole rather than a dissociated collection of parts. It may also be called an ecological view, if the term “ecological” is used in a much broader and deeper sense than usual. This broader and deeper sense of “ecological” is associated with a specific philosophical school and, moreover, with a global grassroots movement, known as “deep ecology,” which is rapidly gaining prominence. The philosophical school was founded by the Norwegian philosopher Arne Naess in the early seventies with his distinction between “shallow” and “deep” ecology. This distinction is now widely accepted as a very useful terminology for referring to a major division within contemporary environmental thought.

Shallow ecology is anthropocentric. It views humans as above, or outside of nature, as the source of all value, and ascribes only instrumental, or use value to nature. Deep ecology does not separate humans from the natural environment, nor does it separate anything else from it. It does not see the world as a collection of isolated objects but rather as a network of phenomena that are fundamentally interconnected and interdependent. Deep ecology recognizes the intrinsic values of all living beings and views humans as just one particular strand in the web of life. It recognizes that we are all embedded in, and dependent upon, the cyclical processes of nature.

Ultimately, deep ecological awareness is spiritual or religious awareness. When the concept of the human spirit is understood as the mode of consciousness in which the individual feels connected to the cosmos as a whole, it becomes clear that ecological awareness is spiritual in its deepest essence. It is therefore not surprising that the emerging new vision of reality, based on deep ecological awareness, is consistent with the so-called “perennial philosophy” of spiritual traditions, whether we talk about the spirituality of Christian mystics, that of Buddhists, or the philosophy and cosmology underlying the American Indian traditions.

In science, the theory of living systems provides the most appropriate scientific formulation of deep ecology. It is a theory that is only now fully emerging but has its roots in several scientific fields that were developed during the first half of the century - organismic biology, gestalt psychology, ecology, general systems theory, and cybernetics. In all these fields scientists explored living systems, i.e. integrated wholes whose properties cannot be reduced to those of smaller parts.



Living systems include individual organisms, parts of organisms, and communities of organisms, such as social systems and ecosystems. All these are irreducible wholes whose specific structures arise from the interactions and interdependence of their parts. Systems theory tells us that all these living systems share a set of common properties and principles of organization.

In our attempts to build and nurture sustainable communities we can learn valuable lessons from ecosystems, because ecosystems are sustainable communities of plants, animals, and microorganisms.



To understand these lessons, we need to learn nature's language. We need to become ecologically literate. Indeed, one of the main reasons we are destroying our natural environment is our ecological illiteracy, our ignorance of the principles of ecology. It is a sobering thought that the average adult in the industrialized world can recognize one thousand brand names and logos but fewer than ten local plants.

Being ecologically literate means understanding how ecosystems organize themselves so as to maximize sustainability. This is the lesson we have to learn to build sustainable human communities. We need to revitalize our communities - including our educational communities, business communities, and political communities - so that the basic principles of ecology become manifest in them as principles of education, management, and politics. Today, this is especially important for business, which has been designed without any attention to the basic principles of ecology. As Paul



Hawken puts it, "what is good for business is almost always bad for nature."

## INTERDEPENDENCE

The first principle of ecology is interdependence. All members of an ecosystem are interconnected in a vast and intricate network of relationships, the web of life. They derive their essential properties

and, in fact, their very existence from their relationships to other things. Interdependence is the nature of all ecological relationships. The success of the whole system depends on the success of its individual members, while the success of each member depends upon the success of the system as a whole.

The principle of interdependence implies a shift of perception from objects to relationships. In business this includes, among other things, a shift from products to services. For example, the managers of a car company should say: We are not in the business of selling cars; we are in the business of providing mobility. This will include cars, but also trains, bicycles, buses, and - above all - integrated systems of these means of transportation. Similarly, the managers of an oil company should say: We are not in the business of selling oil; we are in the business of satisfying our customers' energy needs. The path to sustainable business begins with this focus on relationships, rather than objects or products.

### CYCLICAL NATURE

Another important principle of ecology is the cyclical nature of most ecological processes. The interactions among the members of an ecosystem involve the exchange of energy and

resources in continual cycles - the water cycle, the CO<sub>2</sub> cycle and the various nutrient cycles. Communities of organisms have evolved over billions of years, continually using and recycling the same molecules of minerals, water and air.

The lesson for business here is obvious. The present clash between business and nature, between economics and ecology, is mainly due to the fact that nature is cyclical, whereas our industrial systems are linear, taking up energy and resources from the earth, transforming them into products plus waste, discarding the waste, and finally throwing away the products also after they have been used. Sustainable patterns of production and consumption need to be cyclical, imitating the processes in ecosystems. To achieve such cyclical patterns, we need to





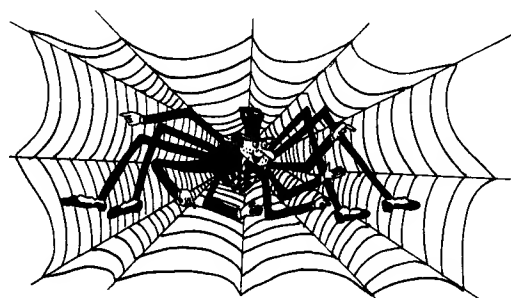
fundamentally redesign our businesses and our economy. Such a redesign of business organizations is currently under way in Sweden, where an eminent cancer researcher, Karl Henrik Robert, has unified the country in moving from linear to cyclical processes in a remarkable nation-wide program, called "The Natural Step."

Solar energy drives all ecological cycles, and green plants play a vital role in this flow of energy. In the marvellous process of photosynthesis, solar energy is converted into chemical energy and bound in organic substances, while oxygen is released to renew the air. Again, the lesson for business is obvious. Solar energy in its many forms is the only kind of energy that is sustainable and economically efficient (if we count the costs of energy production honestly!). By disregarding this principle of ecology, our political and corporate leaders

again and again endanger the health and well-being of millions around the world.

As the nutrients and other resources are passed along through an ecosystem, the organisms along the ecological cycles are engaged in various forms of cooperation. In the nineteenth century, the Social Darwinists saw only competition in nature. Today we know that all competition takes place within a broader context of cooperation involving countless forms of partnership. Indeed, partnership - the tendency to associate, establish links, live inside one another and co-operate - is an essential characteristic of living organisms.

A sustainable business organization will apply this principle to cooperation and partnership along product cycles and in countless other ways, both internally within the company and industry-wide. Here we encounter again the basic tension between economics and ecology that we need to overcome. Economics deals with quantity, competition, expansion; ecology deals with quality, cooperation, conservation.



**PRINCIPLES OF ECOLOGY*****Diversity******Interdependence***

All members of an ecosystem are interconnected in a web of relationships, in which all life processes depend on one another.

The stability of an ecosystem depends on the degree of complexity of its network of relationships; in other words, on the diversity of the ecosystem.

***Ecological Cycles***

The interdependencies among the members of an ecosystem involve the exchange of energy and resources in continual cycles.

***Coevolution***

Most species in an ecosystem coevolve through an interplay of creation and mutual adaptation.

***Energy Flow***

Solar energy, transformed into chemical energy by the photosynthesis of green plants, drives all ecological cycles.

***Sustainability***

The long-term survival of each species in an ecosystem depends on a limited resource base. Ecosystems organize themselves according to the principles summarized above so as to maximize sustainability.

***Partnership***

All living members of an ecosystem are engaged in a subtle interplay of competition and cooperation, involving countless forms of partnership.

The general shift from domination to partnership is an essential part of the shift from the mechanistic to the ecological paradigm. Whereas a machine is properly understood through domination and control, the understanding of a living system will be much more successful if approached through cooperation and partnership. Cooperative relationships are an essential characteristic of life.

***Flexibility***

Ecological cycles have the tendency to maintain themselves in a flexible state, characterized by interdependent fluctuations of their variables.

The principles of ecology mentioned so far - interdependence, the cyclical flows

of energy and resources, cooperation, and partnership are all different aspects of the same pattern of organization. This is how ecosystems organize themselves to maximize sustainability. Once we have understood this pattern of organization, we can ask more detailed questions. For example, what is the resilience of these ecological communities? How do they react to outside disturbances? How do they develop and evolve? These questions lead us to three further principles of ecology - flexibility, diversity, and coevolution.

### ECOSYSTEM'S FLEXIBILITY

Flexibility is manifest in the fact that the network structure of an ecosystem is not rigid but is constantly fluctuating. When changing environmental conditions, e.g., an unusually warm summer, disturb one link in an ecological cycle, the entire cycle acts as a self-regulating feedback loop and soon brings the situation back into balance. And since these environmental disturbances happen all the time, the variables in an ecological cycle (nutrient supplies, population densities, etc.) undergo continual interdependent fluctuations. These fluctuations represent the ecosystem's flexibility. The more variables are kept fluctuating, the more dynamic is the system, the greater its flexibility, the greater its ability to adapt to changing environmental conditions.

All ecological cycles are feedback loops that have the tendency to maintain themselves in a flexible state, characterized by continual fluctuations of their variables. When changing environmental conditions disturb one link in an ecological cycle, the entire cycle acts as a self-regulating feedback loop and soon brings the situation back into balance. And since these disturbances happen all the time, the variables in an ecological cycle fluctuate continually.

These fluctuations represent the ecosystem's flexibility. Lack of flexibility manifests itself as stress. In particular, stress will occur when one or more variables of the system are pushed to their extreme values, which induces increased rigidity throughout the system. Temporary stress is an essential aspect of life, but prolonged stress is harmful and destructive to the system. These considerations lead to the important realization that managing a business organization means to find the optimal values for the systems variables. If one tries to maximize any single variable instead of optimizing it, this will invariably lead to the destruction of the system as a whole.

In ecosystems, this flexibility through fluctuations does not always work, because there can be very severe disturbances that actually wipe out an entire species. In other

words, one of the links in the ecosystem's network is destroyed. An ecological community will be resilient when this link is not the only one of its kind; when there are other connections that can at least partially fulfil its functions. In other words, the more complex the network, the greater the diversity of its interconnections, the more resilient it will be. The same is true in human communities. Diversity means many different relationships, many different approaches to the same problem. A diverse community is a resilient community, capable of adapting easily to changing situations.

### **ECOLOGY AND CULTURE**

The loss of biodiversity, i.e. the daily loss of species, is in the long run one of our most severe global environmental problems. And because of the close integration of tribal indigenous people into their ecosystems, the loss of biodiversity is closely tied to the loss of cultural diversity, the extinction of traditional tribal cultures. This is especially important today. As the beliefs and practices of the industrial culture are being recognized as part of the global ecological crisis, there is an urgent need for a wider understanding of cultural patterns that are sustainable. The vast folk wisdom of American Indian, African, and Asian traditions has been viewed as

inferior and backward by the industrial culture. It is time to reverse this Euro-centric arrogance and to recognize that many of these traditions - their ways of knowing, technologies, knowledge of foods and medicines, forms of aesthetic expression, patterns of social interaction, communal relationships, etc., - embody the ecological wisdom we so urgently need today.

Finally, let us turn to the time dimension of ecosystems. All living systems develop, and all development is learning. Therefore, a sustainable community is always a learning community - a community which continually changes, develops, and learns. At the level of species, development and learning manifest as the creative unfolding of life in the process of evolution. In an ecosystem, evolution is not limited to the gradual adaptation of organisms to their environment, because the environment is itself a network of living systems capable of adaptation and creativity. Organisms and environment adapt to one another - they coevolve. All forms of life on Earth have coevolved in this way as integral components of ecosystems for billions of years.

Coevolution combines the principle of partnership with the dynamics of



change and development. Again, there is a lesson to be learned for business. As business partnerships evolve, each partner better understands the needs of the other. In a true, committed partnership both partners learn and change - they coevolve.

These, then, are the basic principles of ecology - interdependence, recycling, the energy flow from the sun, partnership, flexibility, diversity,

coevolution, and, as a consequence of all those, sustainability. As we go toward the beginning of a new millennium, the survival of humanity will depend on our ecological literacy, on our ability to understand these principles of ecology and live accordingly.

***From : Steering Business Toward Sustainability, Edited by Fritjof Capra & Gunter Pauli, The United Nations University, Tokyo, 1995.***



## MAN : A SEEKER OF HAPPINESS

**T**hroughout the history of man, he has been seeking happiness, at the a) physical, b) mental, c) intellectual, d) moral and ethical, e) philosophical and spiritual and f) social levels.

In fact not only man, all living forms seek this happiness, subject to the kind of equipment they have been provided with.

As life evolves from an amoeba to the human being the capacity to enjoy, the capacity to seek and be aware of happiness, increases. Evolution itself can be defined as the climbing up the ladder of increasing happiness. Life itself can be defined as the “mechanism” for enjoying happiness and removing unhappiness ‘dukha’.

### HAPPINESS AND SENSE PLEASURES AND INTERNAL AWARENESS

While all forms of life seek satisfaction of basic urges such as hunger, sleep, fear and procreation, man alone is capable of seeking higher and more intense forms of happiness.

For an average man happiness is the satisfaction of the needs of the senses of awareness - *jnanendriyas* - good taste, good smell, good sense of touch, good sound, and good sight.

Naturally the objects that satisfy his senses and provide man with happiness are called ‘wealth’, possession of such objects gives a man power over other members of the society who need those objects and satisfies the owner’s ego.

Man also collects these objects which gave him happiness in the past, though, at present the objects may not be required by him. It is a concession to his memory, *chitta*. Sometimes man collects objects to satisfy his intellectual curiosity, and future hopes.

Man may sometimes require objects and tools through which he expresses himself his creative talents, the *karmendriyas*, senses of action, hands, feet, speech, excretory and procreative organs.

Man collects objects, mementos, tools, and power for acquiring happiness.

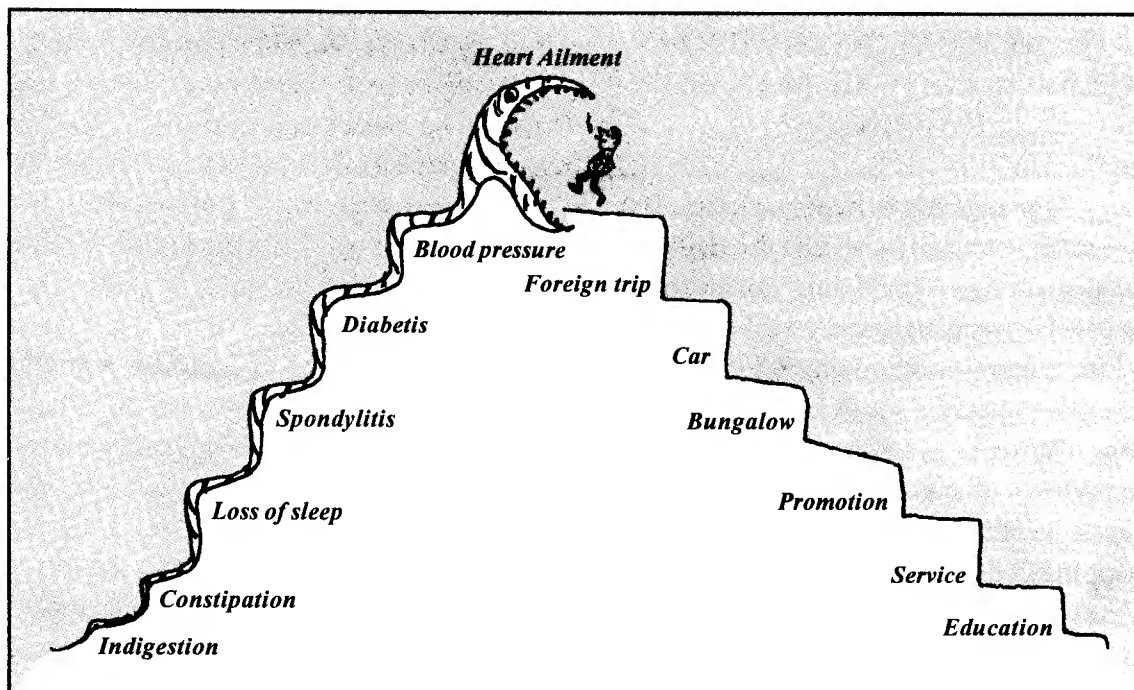
- a) Objects with which to get happiness in the present.
- b) Mementos to commemorate his happy experience of the past with the hope of rebuilding his future happiness.
- c) Tools with which to express himself.
- d) Power to control others and satisfy his ego.

### DO OBJECTS GIVE HAPPINESS?

As man has been acquiring all wealth with the intention of achieving happiness, the natural question arises, whether objects

do give a person happiness. Take the case of a man who eats Laddu to get happiness. If it is Laddu that gives him happiness; a) the more Laddus, the more should be his happiness, b) Laddu should always give him happiness, c) every time he eats a Laddu he should get the same quantum of happiness.

Our common experience does not validate this proposition. The Laddu experience repeated infinitely does not give the man the same amount of happiness. In fact after initial happiness, the increase in the quantity of the object only reduces the happiness.



**T**he present day trend is to produce newer and newer commodities and alluringly advertise them to the people. A thirst to have these ever multiplying commodities, people are always running after money hectically. Can all be successful in the race? So results a cleavage in society with the haves on the one side and have-nots on the other. All the attendant evils of competition, rivalry, jealousy and enmity follow suit. The pity is that even the 'haves', always on the run to 'have' more and more, perpetually remain discontented! Because of the hectic activity and tensions created, the physical and mental strength of the



people suffer a lot. Therefore it is high time to hark people back to the very simple way of living prescribed by the scriptures and even recently advocated by Gandhi. It is time for the Government to cry a halt to helping in this frenzied race by what is called 'raising the standard of living' of the people. If people are to live tension-free and class-conflict free, what the Government must do is, plan to 'lower the standard of living' to that level, where only the basic requirements like simple food, clothing, shelter etc. are fulfilled. Such a life alone will leave people enough time and mood to think of the higher values of life and of God.

*The Sage of Kanchi  
Sri Chandrasekharendra  
Saraswati Swamigal*

experience of the taste and happiness. It is devoid of all thoughts. This time interval is very short. Hence we do not recognize this thought-free state of silence. Soon we come back to the thinking phase. The thoughts about the quality of the dish and the fineness of its preparation start coming back. Based on the experience through taste (memory of past events) we judge whether the object was fine, good or normal. This experience can be verified with other senses too.

Happiness is a state induced normally, but not necessarily always by external objects. This state is a deep experience in which all thoughts vanish.

During sense enjoyments we experience this state for an extremely small fraction of a second. If we could dwell on it for longer durations, this bliss multiplies and new layers of mind unfold themselves. Herein lies the secret of life, the key to evoke the tremendous potentialities hidden in all of us. The inner bliss is so large

compared to the happiness we derive from external sense objects that the desires for sense enjoyment automatically get reduced. Here starts real renunciation.

Not only do the burning desires for sense objects reduce, but also the usual sense pleasures appear to be too small in comparison to the bliss within. Then our system automatically chooses the higher bliss, more lasting bliss. A new way of life emerges. Irrespective of what we have or do not have, we have a satisfying happy life. That is the yoga way of life. Thus the Upanishads provide the basis for yoga (a process to calm down the mind and quieten it fully).

### **SHIFTING OF THE LOCUS OF HAPPINESS FROM OBJECT TO MIND**

The above given ideas shift the locus of happiness from object to the mind itself or the silenced mind itself.

During the height of drug addiction in the US in the late 50's and early 60's experiments were conducted to locate the sensation of the effects of drugs. The two groups of testees were given grass drugged with hallucination inducing substances for a fixed period. After the completion of the period one control group was administered the grass with drug, and the test group was given grass without drug. The test group

members got "stoned" i.e. got the hallucinating experience even without the drug, because they "thought" they were drugged as usual.

The capacity of inner levels of awareness to make up for external stimulation and to draw from inner resources is tremendous.

### **APPROACH OF INDIAN CULTURE TO PROBLEM OF AHARA (FOOD) AND SENSUAL ENJOYMENT**

- 1) The word *Ahara* is generally translated as food. According to Shankara, "that which is gathered is *Ahara*. The knowledge of the sensations, such as sound etc is gathered in for the enjoyment of the enjoyer (self); the purification of the knowledge which gathers in the perception of the senses is the purifying of the food (*Ahara*). The word 'purification of food' means the acquiring of the knowledge of sensations untouched by the defects of attachment, aversion and delusion; such is the meaning".
- 2) A Gnani then draws his *ahara* from within and directly from the elements. Valmiki in his Ramayana describes sages "who could draw their energy

directly from the sun and the moon light. A few could survive on wild leaves. Some others sustained themselves by drinking water alone. Others lived on air”.

- 3) In Tantra the right type of enjoyment (of senses) is said to lead to life immortal.
- 4) “Bhoga verily becomes yoga; the evil turns to good; life leads to liberation in the Kaula Dharma” (*Kularnava* 224). Commenting on this verse, M.P. Pandit writes “Life in the world is turned into a means of approach to and of expression of the divine”.

In the South Indian type of Tantra, sense pleasures are used to reach higher levels of awareness. In the temple worship sweet sound is used to transcend the element of *akasha* (ether). Flowers marking the sense of touch are offered to God in order to help the devotee transcend the element of air (*vayu*). Similarly waving light (sight—energy) offering *naivedya*—tasty food (tongue—water) applying sweet smelling articles nose—earth) are incorporated in worship to satisfy the senses to transcend them and to help the devotee transcend the material world of five elements.

A yogi has to take *sattwic* (balanced nutritious, substantial, juicy) food in right

quantity, according to the Gita. Too much of suffering and too much of starving are to be avoided according to this text.

A yogi who is relaxed *obviously* uses less food. The human body spends a minimum of 1500 calories per day to energise its blood circulation, breathing, involuntary actions, digestion etc. If the person is tense, the system uses more food, more energy and the absorption of energy from food is less. A relaxed person uses less food to keep himself going. Not only that, he makes better use of his food.

The Svetasvataropanishad (II,13) says,

*“It is said the first signs of entering yoga, are lightness of body, health, thirstlessness of mind, clearness of complexion, a beautiful voice, an agreeable odour and scantiness of excretions”.*

Yoga texts and practitioners recognise that obese persons over eat because, even after their bodily needs of food are satisfied, mental craving remains and the individual over eats in a bid to satisfy the mind, (pranic energy is hasty action).

In such cases the yoga practice is to slow down the mind by relaxation, breathing and meditation exercises, and masticate the food 32 times to allow the mind sufficient

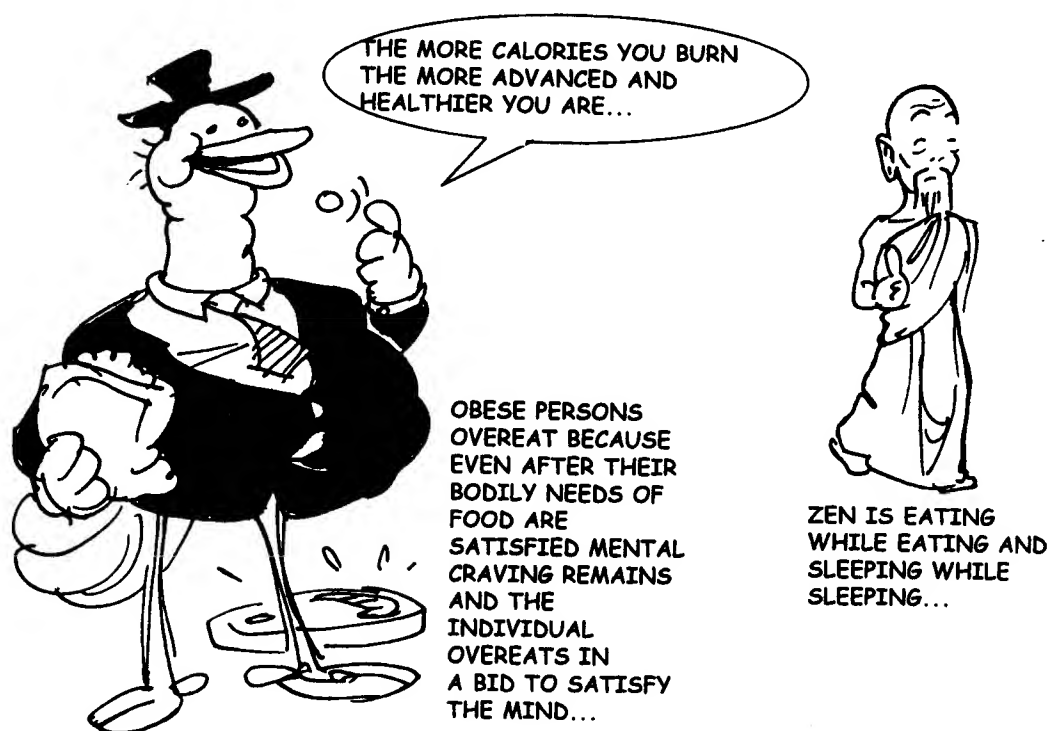
time to enjoy the food. The food intake automatically comes down resulting in weight reduction.

In Zen, a teacher tells the student, "Zen is eating while eating and sleeping while sleeping" meaning, when a person eats with all his mind upon the process of eating, he attains perfection.

Oriental texts recognize various layers of human consciousness, physical (Annamaya), energy based (Pranamaya), emotional (Mamomaya), intellectual (vignanamaya) and bliss based

(Anandamaya) each needing feeding, and taking its own time to be satisfied. Slow, conscious eating with full mastication brings down the food needs of the individual, communities, nations and the entire humanity.

Western approach to human needs of food etc take man as a constant whole inflexible in his needs and wants, unchangeable in his attitudes, and no education can be possible or necessary to change his physical needs. Nutritionists, economists, food specialists, conservationists and politicians, neglect the funda-



mental and scientific fact with the result, scientific bodies, experts, planners, set standards for individuals, nations and societies in the field of nutrition and energy requirements and by extensions all objects of enjoyment including those that seek to gratify the five senses.

Obviously the western scientific thinking has its own biases. 'Greater the energy consumption better is the civilization' is their approach.

A disciple of Swami Sivananda of the Divine Life Society used to say this of the Calorie theory. "This is not calorie theory. It is actually colliery theory. As England was a cold country, producing a lot of coal and chalk, all their scientific thinking came to be centred around greater consumption of energy, heat, coal etc. The more calories you burn, the more advanced and healthier you are, your nation is more civilized".

Our great saint Kanchi Paramacharya, who walked around India four times, used to take only three handfuls

of puffed rice and lived up to 100 years. That much for the calorie theory!

Unless the conceived relation between consumption and health, enjoyment and happiness is broken, all attempts to preach simple living, tightening the belt will be looked down upon as faddistic, illogical, and playing economics against health.

In matters, not concerned with himself, man's approach appears to be much more logical and scientific. Sprinkler irrigation, drip irrigation, spot irrigation, and optimum use of fertilizers and pesticides, have proved to man that inputs need not be in excessive quantity for maximising production in agriculture. Optimum body weight in milch animals matched against milk production also gives a clue. If anything, human mind should help man to absorb subtler energy from nature and to reduce dependence upon external inputs without loss of health or efficiency.

*(Yoga - its Basis and Applications, vol. I, page 34-36, Dr H.R. Nagendra)*





## RETHINKING GROWTH

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WOLFGANG SACHS

Wuppertal Institute of Climate, Energy and the Environment, Germany.

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I would like to step back and look at the way we perceive our civilisational crisis, to look at it a little bit from a distance. I am not an economist. I am speaking, I guess, as a cultural historian - somebody who tries to figure out how perceptions and cosmologies are changing.

What is the magnitude of the civilisational crisis? At the Wuppertal Institute, we ask ourselves: To what extent do Northern countries like Germany have to change if they want to go towards a sustainable society and towards a society which in some measure might be globally just and might answer to the requirements of global justice?

If we listen to what the climate specialists are saying, to keep the heating of the atmosphere to a minimal limit, we will have to decrease our throughput of energy by 50 per cent in the next decade. Northern countries which have only 20 per cent of the world's population, use 80 per cent of the world's resources. If we put those two situations one on top of the other, the Northern countries have to reduce their

throughput of energy by 70-90 per cent within the next 30-40 years. Now, there we have a major challenge.

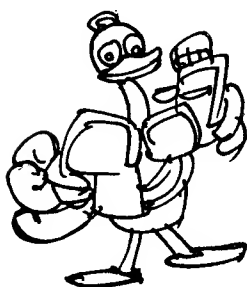
What I would like to do is simply to contrast two basically different, but not contradictory, approaches to that challenge. And I would like to make a difference between an ecology of means and an ecology of ends.

I was told that till recently the Tokyo subway stations were plastered with commercial posters. It was like walking through paper tunnels. At a certain point, responsible people said this is a waste of paper and we know Japan is accused of ripping other countries' forests for producing paper. They came up with a clever solution – television monitors which bombard people with commercials.

To me, this anecdote reveals what an ecology of means is all about. Many people have talked of that – monitors instead of paper, sophisticated engines instead of fuel consumption and recycling instead of new production. An ecology of means attempts

to reassemble the tool parts of society, to screen the tools available, and to throw out those tools which are wasteful and harmful. Definitely, the aim is to decrease

#### RETHINKING GROWTH:



THE AIM IS TO  
DECREASE CONSUMPTION  
-- WITH LOTS OF NEW  
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WHAT IS TECHNICALLY  
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BECOME ECONOMICALLY  
FEASIBLE

consumption. There is lots of new technology available, and what is technically feasible has to become economically feasible.

Of course, what is incredibly important is a very basic reform of taxes in our countries. But not just a tax reform, in order to bring in some more income for the



THOSE WHO CONSUME AND  
POLLUTE NATURE SHOULD PAY.

finance minister, there has to be a change in the fiscal base of states. This is because, for many years now, we have taxed labour. And what is now on the agenda is taxing the consumption of nature. Those who consume and pollute nature should pay. For one-and-a-half centuries in the history of industrialisation, we have employed technology to increase the productivity of labour. Now probably the era has started in which we have to invest in technology to decrease the productivity of nature. The simple rule being that what you do not want will be taxed away.

There is so much leeway in the ecology of means that many people are singing praises of the efficiency revolution. Let me examine that a little bit. Conversations which revolve around efficient allocation of means and resources have, in my view, a major problem at the level of logic. Of course, we can save nature by using our resources more efficiently. But only for a certain time, when there is growth.

Let me take a simple example. It is obvious that in the last 20 years, the fuel efficiency of cars has grown enormously. Nevertheless, the problem of cars is far from being solved. Why? Because while efficiency grew, the number of cars and the power of cars also grew. And kilometres travelled have increased. We introduced efficiency but, at the same time, the gains

achieved have been eaten up by continuous growth.

So success in rationalisation may help save time. But it seems to postpone the more fundamental problem rather than solving it. Or to put in a different way, efficiency gains might be effective only in the long run in a growth-indifferent economy.



**THE MOST ECONOMICALLY  
ADVANCED SOCIETY ALSO  
USED LESS ENERGY AND  
LESS WATER.**

At the macro level, many environmentalists were happy to look at Japan because they discovered that the most economically advanced society was also at the same time a society which, environmentally speaking, used less energy and less water. It could thus be shown for some time that growth could be uncoupled from the consumption of nature. Most recent studies show that that was basically true for the period between 1970-1987. And now a recoupling of growth and nature consumption has begun again.

After a certain time, growth surpasses the gains we have achieved through efficiency and then we are left at a level where it becomes very difficult and very costly to introduce new types of efficiency. I would like to use an analogy stolen from Herman Daly. Imagine the economy is a boat on which more and more cargo is being loaded. You are well advised to distribute your cargo more efficiently in order to avoid the boat tipping over. But at a certain point inevitably, the boat will sink, even if it sinks in an optimal manner.

The conclusion? An ecology of means has to be accompanied by an ecology of ends. In other words, ecological reconversion can only come about by an intelligent use of means. It has to walk on two legs, so you need the moderation of goals. Or, to put it in yet another way, it seems that the efficiency revolution will remain counterproductive if it is not accompanied by a sufficiency revolution. These things are basically simple, though they look complicated. Nothing is as irrational as running with high speed and with utmost efficiency in the wrong direction.

We need a worldview of social and cultural projects in which economic calculations are embedded. There will be no hope of confronting the environmental crisis in the North if there is no image shift - an image shift which can be compared

with, if I take a cruel example, the French Revolution. The moment a king was beheaded, it became suddenly possible to think of democracy. It was not possible before. Things happen, which suddenly throw open a window and then another perception of reality becomes possible.

## NEW MODELS OF WEALTH

I would like to talk about different ways in which people in my country are searching for a new understanding of prosperity - in fact, searching for new models of wealth, if you like, because that is the real issue. A society tries to search for its indigenous mode of prosperity.



MOST OF THE  
ASPIRATIONS WE  
RUN AFTER HAVE  
BEEN BORN IN THE  
19TH CENTURY.

**1. The first one is an unhurried society :** It seems to me that most of the aspirations we run after have been born in the 19th century. We are still wrapped up culturally in our worldview, in a dress which was woven in the last century. And we are about to confront the challenges of the 21st century in that dress. Is it not time to shed the clothes of the last century? I mean the

kind of growth and the kinds of aspirations which have grown there.

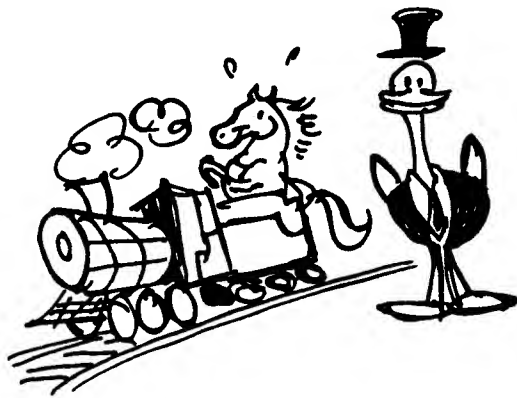
I like to look at words because as words change, they reveal undercurrents. If I used the word tempo with Otto Von



TEMPO IS MUSIC IN THE RIGHT  
RHYTHM, AT ITS PROPER SPEED

Bismarck (founder and first chancellor of the German empire), he would have thought of music. Tempo is music in the right rhythm, at its proper speed. Already around the turn of the century, tempo in dictionaries meant maximum speed. So, within a couple of decades, the meaning changed from the right rhythm to the appropriate rhythm to the maximum speed. Which means that now the proper rhythm is the maximum speed.

The reason is not so difficult to find. The desire for acceleration has to do with the invention of the locomotive. The locomotive replaces animal power, the



**LOCOMOTIVE REPLACED  
ANIMAL POWER**

horse in particular. This is the history of transportation. The horse in the end was an animal which got tired, exhausted, sick and, above that, had to eat on time. The locomotive promised something else. It promised speed, accelerable speed or increasable speed and inexhaustible speed. The same is true for the rail. The rail does not go along the curves of nature, like valleys or mountains, but cuts right through, over valleys, penetrating mountains. So the idea grows that acceleration can take place in an increasing and infinite manner. The very idea of progress in the 19th century is a locomotive idea. It could not have been conceived without seeing motorised transport. The classical economists, Adam Smith, Malthus and even Ricardo, did not have a notion of economic growth. Or to put it more carefully, they did not have a notion of more or less infinite, steady and permanent economic growth. They had a notion of improvement, yes, but not of

growth. Still, at that time, they saw that the resources available for industry were biotic resources - vegetables, vegetative resources, basically timber, cotton and so on.

Clearly enough it is unimaginable that you can increase the availability of biotic resources infinitely because they are always linked to the process of regeneration. So, still for the founding fathers of economics, the idea which is so familiar to us was impossible.

Only after the steam engine we come to the locomotive. The steam engine began to conquer people's perceptions. It was possible to conceive of an economy which, like the locomotive, continues to grow.

We have one technology where the idea of acceleration is incredibly alive and has shaped the course of technological development, that is, the automobile. Today our automobiles are built as if you have to participate in a race every day. They are built for a speed of 200-250 kilometers per hour (kmph). Now, an automobile on an average spends about 80-90 per cent of its time in urban traffic at a speed of about 15-20 kmph. Sending today's cars into urban traffic is as rational as cutting butter with a chain-saw. The ideology of acceleration has brought us into a technological development which is in a way grotesque. Because it has over

instrumentalised us and has brought us into a situation which is even intrinsically irrational. In a fully motorised country, acceleration shows its counterproductive side.

That has an inherent dialectic. Acceleration is, in a way, an enemy of looking more closely at the here and now. It pulls you away from enjoying more precisely an attempt to live with the present. Intensity for the present by itself leads to deceleration. If you want to be at peace with nature, why is it so impossible to think about low speed cars? You get a totally different magnitude of fuel consumption, land consumption, material-use, death, accidents and so on.

When you think that the future certainly will be brighter than the present, you run faster. But when the future, as it is today, is wrought with uncertainty, why should you run? It seems to me that a society of the 21st century should be able to liberate itself from the burdens of the 19th century and should be able to afford more serenity.

**2. Shorter distances and regeneration of places :** That is another utopia which is with us from the 18th and 19th centuries. That to achieve unity in the world, you need to increase economic interdependence. That is the utopia behind the General Agreement on Tariffs and Trade

(GATT). That is the utopia behind European unification. Interdependence leads to welfare and wealth. The grand myth of today is that planetary economy is desirable. It is not desirable, it is certainly inevitable. The shadows somehow get longer for political reasons, the maxim or the slogan to secure the competitiveness of your country is becoming an overriding slogan, which crowds out all other political and social concerns. Be it for quality of life or be it for a different kind of technology.

It is true that democracy can be strangled by isolation. However, we also have to concede that democracy can be blown away by unconditional exposure. Democracy, whichever way we understand it, will need some space of its own, will need some space for self-determination and will need some sovereignty, be it national or something else. Interdependence and entanglements need transport, distances between producers and consumers grow, the supply lines grow. In Germany we get flowers from Kenya and shoes from Taiwan. Somebody in our institute has made a calculation of the transport intensity of the little containers of yoghurt that we get on our breakfast tables. The strawberries come from Poland, the colour from Holland and the plastic from somewhere else. She came up with the result that in one container of yoghurt are 9,000 km of transport.

instrumentalised us and has brought us into a situation which is even intrinsically irrational. In a fully motorised country, acceleration shows its counterproductive side.

That has an inherent dialectic. Acceleration is, in a way, an enemy of looking more closely at the here and now. It pulls you away from enjoying more precisely an attempt to live with the present. Intensity for the present by itself leads to deceleration. If you want to be at peace with nature, why is it so impossible to think about low speed cars? You get a totally different magnitude of fuel consumption, land consumption, material-use, death, accidents and so on.

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ONE CONTAINER  
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Today, people are talking about lean production, meaning reducing a part of production in the main factory and farming out a number of processes to supply industries. Now, again, I would say, excuse me, but lean production is fat transportation, is it not?

Without being dogmatic, I would say a sustainable and just society has to envisage a loosely connected economy, an economy which is basically based on local economies. Where there is more local autonomy and, where there is also, of course, as you said in the seminar, biomass-based technology which offers new possibilities for democracy and for autonomy at the local level.

### **3. The founding fathers of economics have asked themselves**

#### **where does our wealth derive from?**

Smith said our wealth derives from human labour and, more precisely, from human labour which produces for the market. That was at the time an innovative statement and as you know, it turned around all our thinking. In a way, that is another way of saying what I have been saying. Ideas which are innovative at one point, they become conventions and then they turn into frustrations. I guess that is the way cultural notions run. In the notion that human labour is the source of wealth, there were two blind spots. One blind spot, nature, fell into oblivion. That brought us, in a way, into the environmental crisis.

The other blind spot, community, also fell into oblivion. Everybody knows that in our daily life, our welfare and wealth depends very much on domestic labour, on devotion of people, on friendship, on community associations, on works of solidarity and so on. And as you know much better than I do, people have tried to calculate the contribution of informal work. It is always 13-14 per cent of the gross national product.

One can even offer the conclusion that probably the commons are the foundation of wealth creation which takes place later in offices and factories. Is it avoidable to ask the real, basic questions:



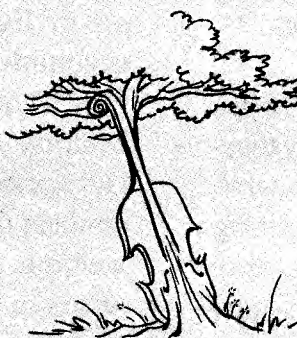


THE MOST IMPORTANT  
RESOURCE WE NEED TO ENGAGE  
IN NON-COMMERCIAL ACTIVITIES  
IS TIME...

How can we live graciously without economic growth? If we begin to address that heavy question, then one possible answer is to discover new commons, or if I might phrase it in economists' terms, to think even of what kind of infrastructure investment and financial promises we have to offer in order to give a boost to non-commercial activities. The most important resource we need to engage in non-commercial activities is time. Now, in our countries at least, they talk about consumer sovereignty, but there is one choice we are not allowed to make, that is to choose

### CHANGE YOUR LIFESTYLE

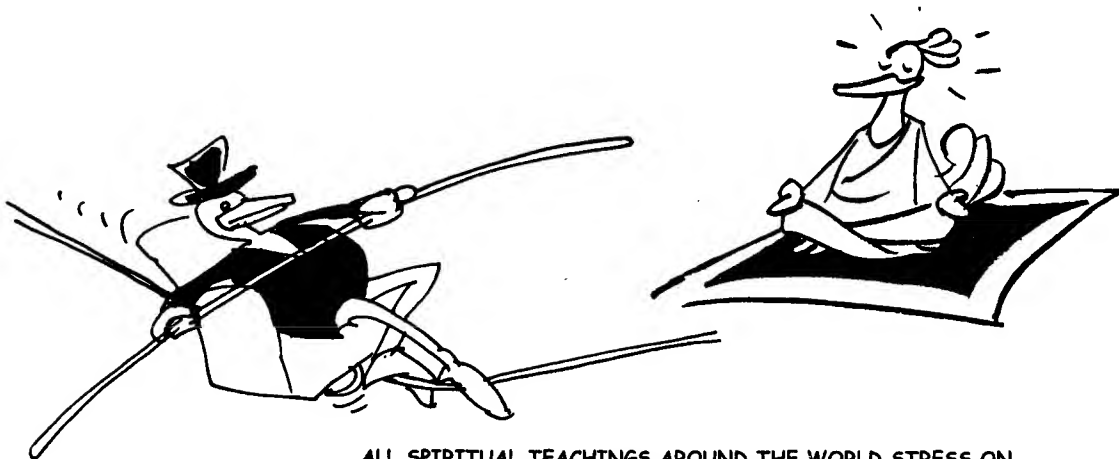
*"The real challenge is to find a way of dismantling the consumer society and replacing it with a society rich in satisfactions and pleasures which make shopping and material acquisition pale by comparison. The switch depends on individual lifestyle changes and an increase in creative expression, as well as on a restoration of community bonds and determination to find ways of demonstrating a way of life which is attractive and exciting. As our values change, our ideas about appropriate consumption will change naturally and painlessly.*



Music should continue

*Telling people that they will have to consume less is a mistake. We ought to be talking about a more satisfying and sustaining society (in which, as it happens, we will consume less), not one of hardship and deprivation. By demonstrating that we can find our satisfactions in our work, in physical activity and the natural world, and in loving relationships, by living with vitality and joy and courage without becoming smug or puritanical, we have a good chance of promoting the necessary changes in the values of our society."*

**- Karen Christensen**



ALL SPIRITUAL TEACHINGS AROUND THE WORLD STRESS ON  
SIMPLICITY IN THE CONDUCT OF ONE'S LIFE

between free time and our income. So, one prerequisite is to regain the sovereignty over time, to increase vastly the possibility of part-time work, the possibility of taking off for a year, taking off for three years or working only three days a week and so on, with a decisive point to open up the possibilities of non-commercial work.

That brings me to the other prerequisite. As you know, our social security is very closely linked to what we earn. If we try to double the lifelong earnings from social security, the entire discussion on minimum income comes in. The only thing I want to say is: freedom from rigid time schedules and minimal income for us are pillars of a new social order as well as pillars of a growth - indifferent economy.

**4. Selective consumption or the smartness of simplicity:** If one looks

around the world, at all the spiritual teachings, different stories about the nature of the universe, and, of course, history - they tend to converge when it comes to advice about the conduct of one's own life, they tend to talk about simplicity. It has something to do with the art of living, with the search for an accomplished life. As I went through a little bit of our literature, it struck me that contrary to the simple life, luxurious life is fragmented life. Many things in a way congest the day, dissipate energies and weaken attention. So anybody who wants to have enough attention on his own life project is well advised to be very selective about engagements.

The plea for simplicity has nothing to do with morals, but rather with aesthetics. Art depends on the careful use of sounds and colours and the same might be true of

the art of living - it depends on the careful use of material things.

There is a formula which everybody knows - the underlying relationship between austerity and hedonism. The US philosopher, Henry Thoreau, I guess

knew all of that 180 years ago, as he scribbled in his diary: 'A man is richer in proportion to the number of things he can afford to let be'.

***From : The Challenge of the Balance,  
Edited by Anil Agarwal.***



## ECO-DHARMA ENTERS THE WORLD

**A**s we have entered the New Millennium, we have to wake up: so much is required of us to make this millennium one of sanity, harmony and peace. One of the changes we need to make is within ourselves, namely, to realize that many of the old venerable precepts will have to be given a new lease of life. Thus Dharma has recently been given a new dimension as Eco-Dharma.

E c o - Dharma is a *new awareness* of what our present world and future generations require for a meaningful existence.

Eco-Dharma is a call *to action* to protect the beauty of the physical world which is our cradle, our vessel, our nurturer, the source of our spiritual sustenance.



Eco-Dharma suggests and proposes a profoundly new interpretation of old scriptures which must be seen as the hymns to the glory of all - creation sent also invitations to the participatory dance, in which the Atman enshrines Brahman by truly taking care of its well-being - including this world. Yes, we are contributing to the well-being of God.

Here are some of the precepts of Eco-Dharma.

1. Live simply so that others may simply live.
2. Practise frugality. Frugality is grace without waste.
3. Vote judiciously. We vote most eloquently with our lifestyles.
4. Eat simple food which is grown locally and which (preferably) is vegetarian.
5. Keep your confidence, keep believing in yourself, keep believing in the future.
6. As we are, so we think, so we behave - so we create the environment around ourselves. Purify yourself, keep clean within, create inner peace - then you will be capable of creating right environments. The inner temple and the outer temple are aspects of each other.
7. Our Dharma has many aspects, many layers, many depths. In our times Dharma has been extended to include our care for Mother Earth. Eco-Dharma is a new blossoming of Dharma. Keep Eco-Dharma in your mind and heart all the time. Inspire others with this Dharma.
8. Your harmony with nature and other beings is a prerequisite for living sanely. Maintain this harmony. Develop right consciousness, which is holistic and ecological, based on compassion, cooperation, peace.
9. Walk in beauty. Embrace the universe reverentially. This will lead you to a spiritual path. Following this path will lead you to genuine happiness.
10. The main aim of Eco-Dharma is to make ourselves sacred while taking all creation with us.

*An extract from Henryk Skolimowski's forthcoming book: Ecology and Dharma in the Third Millennium.*

### **GIFT OF EARTH**

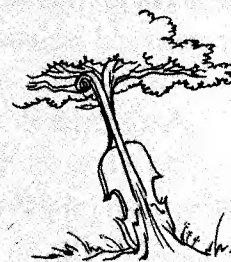
*"It is in exchanging the gifts of the earth, that you shall find abundance and be satisfied.*

*Yet unless the exchange be in love and kindly justice, it will but lead some to greed and others to hunger.*

*And before you leave the market-place, see that no-one has gone his way with empty hands.*

*For the master spirit of the earth shall not sleep peacefully upon the wind till the needs of the least of you are satisfied."*

**- Kahlil Gibran.**



**Music should  
continue**

## YOU ARE, THEREFORE I AM

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SATISH KUMAR

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**W***holeness and harmony are the foundation stones of a new world-view.*

“I Think, therefore I am” is the famous phrase coined by Rene Descartes. This has become the motto of the modern mind. Descartes championed the mind-matter split. Since then, Western science, philosophy and education have been based on the subject-object divide and the human-nature divide. Much of our social and political paradigm stems from this dualism.

From this dualism flow individualism, industrialism, humanism, capitalism and egoism. Dualism also gives birth to fragmentation, separation, alienation and isolation.

That I exist in my thoughts and in my mind is only partially true and therefore is a flawed philosophy.

My existence is a network of influences. I exist in a web of relationships: in reciprocity, mutuality and community. I am because earth, air, fire

and water are. I am because my parents, my teachers and my friends are. I am because Buddha, Krishna and Christ are: they are part of my thinking. Shakespeare is, therefore I am. Beethoven is, therefore I am. Van Gogh is, therefore I am. Gandhi is, therefore I am. You are therefore I am. Worms are, therefore I am.

Buddhists call it *co-dependent arising*. Hindus call it *Sohum*: “That is I,” and “I am that.” In South Africa they call it *Umbutu*: “I am because we are.”

It would not be the whole truth to say that “I write, therefore I am a writer.” Writing involves much more than just being able to think and write. It is as much true to say that “You are a reader, therefore I am a writer.” The relationship between the reader and the writer, the paper and the pen and the publisher and the subject matter are all equally important aspects of writing. This is linked-up or joined-up thinking. It is a participatory, relational, connective and integrated way of looking at life and seeing it whole.

This view of a world of relationships is the underlying theme of this issue. Richard Tarnas looks at the history of Western thought and weaves together a new synthesis. Maurice Ash imagines how our education and agriculture, politics and planning would be shaped if we were to build them on the foundations of wholeness. Vandana Shiva and Bill Devali explore the same ground from the perspective of deep ecology. Scilla Elworthy examines the field of peace, non-violence and conflict resolution from a holistic point of view: if there is no separation, no dualism, then who is our enemy? With whom are we fighting?

The implication of Peter Melchett's challenge to Monsanto and Michael Bond's challenge to planners is the same. We are nature and nature is us. Nature is, therefore we are. No



need to fight against nature or try to conquer it. We need to be humble and learn to live in harmony with nature. *If we do this, we will appreciate the beauty and simplicity of local time, local food, local schools and the local economy.*



# RIO AND AFTER

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CHRISTOPHER FLAVIN

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## 1. INTRODUCTION

The Earth Summit was held in Rio de Janeiro in 1992 but the world is falling well short of achieving its central goal – an environmentally sustainable global economy. (1) Since then the human numbers have grown by 450 million. (2) Annual emissions of carbon which produce carbondioxide the leading greenhouse gas, have climbed to a new high, altering the very composition of the atmosphere and the earth's heat balance. (3) Between 1992 and 1997, the earth's biological riches have also been rapidly and

## DEVELOPMENT



irreversibly diminished. (4) Huge areas of old growth forests have been degraded or cleared, in temperate as well as tropical regions, eliminating thousands of species of plants and animals. (5) Biologically rich wet lands and coral reefs are suffering similar fates. (6) Despite economic growth in developing countries nearly 1.3 billion poor people cannot meet their basic needs of food or shelter. (7) Only half a dozen countries have levied environmental taxes to discourage the unsustainable use of materials energy. On the other hand, many other nations continue to subsidize deforestation, wasteful energy and water use and mining. This was against the spirit of Rio.

In Rio, environment and development issues were officially linked. Poverty is recognised as a driving force behind a large share of environmental degradation. Although many think of development in simple economic terms, it can be better thought of as an increase in the options available to people - for meeting their basic needs for food, shelter, and education, for example. As biological and cultural diversity are diminished, those options are reduced.



Environmental and social problems in many countries create millions of refugees. Sometimes violent conflicts result. Yet most governments still pursue economic growth as an end in itself neglecting social sustainability.

The world has failed to meet the broader challenge of integrating environmental strategies into economic policy. Such integration can come up only from grass root organizations and local governments. Unfortunately, the world has not moved in earnest in this direction.

## 2. THE ROAD FROM RIO

The Rio goals included a) protecting wet-lands and deserts b) reducing air and water pollution c) improving energy and agricultural technologies d) managing toxic chemicals and radioactive wastes more effectively and e) reducing the incidence of disease and malnutrition.

Very little money has been spent on the implementation of the Rio agenda. This is in spite of the speeches and commitments made by a hundred world leaders at Rio. To add to the sorry state the economic and social pressures have made rich countries feel poor leading them to cut back on domestic expenditure and foreign aid for social programmes.

International Financial institutions such as the World Bank (which lends 20 billion dollars annually to developing countries) can play an important role in promoting environmental and social sustainability but unfortunately while their top brass swear by sustainability, the smaller minions go by profit, sustainability or no



"OF COURSE, I'M WORRIED -- THERE'S NO SAND TO BURY MY HEAD IN."

sustainability. In industrial countries, air and water pollution position has eased. Even developing countries, are concerned with air pollution, lead in gasoline, production of chemicals, that deplete ozone layer. These are healthy signs.

In some areas, the world moves on the reverse gear. Three global problems stand in the way of achieving a sustainable world: 1) Human induced climate change 2) The loss of biodiversity and 3) Expanding population and consumption level.

### **3. EIGHT ENVIRONMENTAL HEAVY WEIGHTS**

There are 8 nations that disproportionately shape global environmental trends. They are :

- 1) China, the country with the largest population.
- 2) The US, largest economy and carbon emissions.
- 3) Brazil, with the richest array of biodiversity.
- 4) Russia, largest share of forest areas.
- 5) Japan, second largest share of gross world product.
- 6) Germany, (third) with great public awareness.
- 7) India, second largest population.
- 8) Indonesia, high share in world biodiversity.

These countries are called E8. Bridging the north and south differences, the E8 could catalyze action. A key challenge will be to focus on the common interests of all countries rather than on national interests, in the struggle for a sustainable world, the fates of rich and

poor, of North and South, are inextricably linked.

### **4. STABILIZING THE CLIMATE**

In the five years since Rio, the urgency of the climate problem has grown. The atmospheric concentration of carbon dioxide at its highest level in 1,50,000 years is found today; and it is still increasing. The world is facing a rate of climate change in the next several decades that exceeds natural rates by a factor of ten. The rapid climate change ahead is likely to be erratic, disruptive and unpredictable. Local weather patterns may shift suddenly. The incidence of floods, droughts, fires, and heat out- breaks will probably increase as global temperatures rise. The convention on climate change risks is becoming an empty vessel : strong on principle but desperately weak in implementation. A powerful fossil fuel lobby prevents serious discussion and meaningful action. Global emissions of carbon from fossil fuels will exceed 1990 levels by 17 percent in 2000 and 49 percent by 2010, reaching nearly 9 billion tons annually.

### **5. CONSERVING BIOLOGICAL WEALTH**

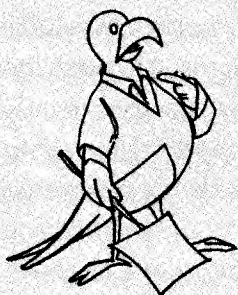
A top biologist calculates that the rich fabric of life that makes up the earth's ecosystem is being ripped up at the rate of 50,000 species a year. Tropical rain forests

and other natural ecosystems, fresh water lakes, streams, coastal mangroves, coastal reefs and temperate rain forests are being invaded by agriculture, human settlements, water diversion and pollution. Three fourths of the world's bird species are declining. One fourth of the 4600 species of mammals are threatened with extinction. Rapid climate change is causing the species loss. For the first time in the history, a single species - human beings - has become a vast, destructive, ecological force. China has become a typical model of increasing

population crowding out 15 to 20% of the species in that country.

## 6. LIMITING HUMAN NUMBERS AND CONSUMPTION

In order to conserve biodiversity in the long run, we will have to slow down growth in human numbers and reduce the poverty in the South and over-consumption in the North that drive people to clear land. The world which began the 20th century with 1.6 billion people ended it with more



**Listen**

### IF FEW PEOPLE CAN CHANGE THEIR LIFE STYLES THE WORLD POPULATION CAN BE FED COMFORTABLY

The question as to whether we can produce enough food depends on what levels of consumption we are talking about. Lester Brown has calculated that taking into account the UN population projections for the year 2030 and projected estimates of grain production:

8.9 billion population

2.2 billion tonnes of grain production

This will mean that at current levels of consumption 2.75 billion Americans, 5.5 billion Italians and 11 billion Indians can be fed. As far as adequate standards of nutrition are concerned we can feed the global population, comfortably until 2030 i.e. when the global population is estimated to stabilise, but if we use consumption, we are in for trouble. With the present levels of consumption (or waste) of the North, we would need six or seven planets resources to deal with the problem.

*Kamla Choudhry, Founder Chairperson, National Wasteland Dev. Board.*

*From the Hindu, Dated 13/04/1997.*

than 6 billion people on the planet, up by 3.5 billion (58%) just since 1950. Population growth is the force behind many environmental and social problems. While every problem in the book can be traced to the population growth as its origin, the resource consumption levels of individual nations are of great importance. The annual increase in the US population of 2.6 million people puts more pressure on the world's resources than do the 17 million people added in India each year.

A very urgent necessity is for the rich countries to develop less resource intensive life-styles and less polluting technologies. Only then it will be possible to develop a sustainable world economy at a stable world population of twelve, ten or eight billion people. A top German institute has concluded that by using resources more productively, it will be possible to reduce energy and material consumption levels in industrial countries by a factor of four while actually improving the standard of living. The model of industrial countries today is being followed by developing countries. Therefore, resource and pollution efficiencies of the rich countries are of worldwide significance.

## 7. A HAPPY NOTE FOR ENDING?

Paul Hawken, a successful California business executive, noted in his 1993 book *The Ecology of Commerce*: "We have reached an unsettling and portentous turning point in industrial civilization.. Business people must either dedicate themselves to transforming commerce to a restorative undertaking or march society to the undertaker."

In response to such calls, many business leaders now point out that rapid advances in electronics, materials science, and biotechnology offer important solutions to environmental problems. Although there are still many business groups that vociferously oppose and lobby against environmental progress, their messages now compete with more progressive voices, such as the World Business Council for Sustainable Development or the sixty insurance companies that gathered at the climate parley in Geneva in July 1996 to urge 'early, substantial reductions in greenhouse gas emission'.

*From : State of the World 1997,  
W.W. Norton & Co., New York.*

# NATURE'S LIMITS

LESTER R. BROWN

## 1. INTRODUCTION

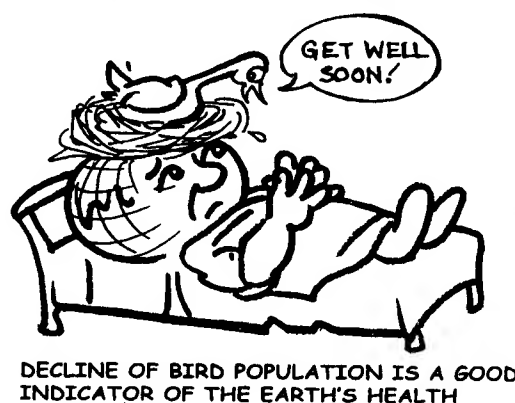
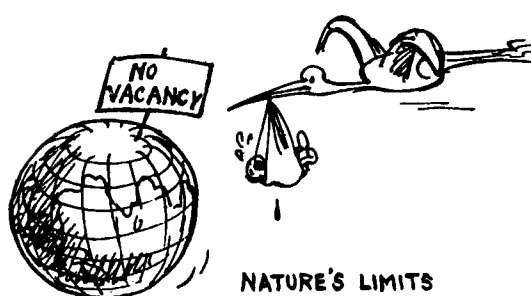
The Cairo conference of 179 nations on Population and Development held in September 1994 evolved a strategy that reflects a sense of urgency -- a feeling that unless population growth can be slowed quickly, it will push human demands beyond the carrying capacity of the land in many countries, leading to environmental degradation, economic decline and social disintegration. The plan calls for providing services to 120 million women and removing female illiteracy: Universal primary school education for girls as a way to lower fertility level. The Cairo goal will be to stabilise the world population at 9.8 billions by 2050, a tough goal by any standard. 8-9 billion will satisfy one of the conditions of an environmentally sustainable society. There

are natural limits of the earth. And there is a need to respect these limits.

## INDICATORS OF ENVIRONMENTAL UNSUSTAINABILITY

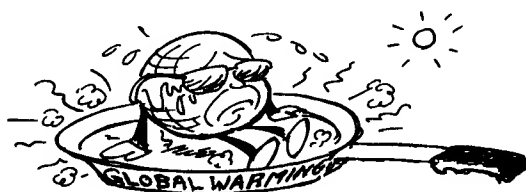
The mid-nineties saw the shrinking fish catches, falling water tables, declining bird populations, record heat waves and dwindling grain stocks - all indicating unsustainability.

World's fish catch climbed four-fold in forty years (1950-1990). But oceanic fisheries cannot sustain a greater catch. The world faces a declining sea-food supply per person and rising prices for decades to come.



Concern over water supply is rising in many areas, Beijing in China, Washington DC, being no exception.

Decline of bird population is a good indicator of earth's health. World's bird populations are dropping in every continent. Of the 9600 species, only 3600 are holding their own. The other 6000 are on the decline. Of these, the population of some 1000 species are being threatened with extinction. The reasons include deforestation in the tropics, drainage of wet lands for farming and residential constructions; air and water pollution; acid rains; and hunting.



For two decades (up to 1995) the global average temperature has been steadily rising. After 1994, again the world's average temperature is rising. A pre-monsoon heat wave in India lasted several weeks with temperatures up to 46° C taking a heavy toll on humans and livestock in the regions. In the western U.S. hot dry conditions rose to new peaks leading to a number of forest fires. Hottest summer in Japan has forced many utilities and manufacturing firms in Tokyo to import water by tankers from far away

Alaska. Shanghai had fourteen days above 35°C. Northern Europe suffers mid-summer temperatures above 32°C exposing residents and eco-systems to accustomed levels of heat.

On the food-front, global food security declined further as the world's projected carry-over grain stocks from the 1994 harvest dropped to the lowest level in twenty years. Spreading water shortages, declining fertilizer use and cropland losses particularly in Asia, led to another harvest shortfall and the draw-down in stocks.

Thus, in various ways, Nature's limits are beginning to impose themselves on the human agenda, initially at the local level but also at the global level. Shrinking fish yield and spreading water scarcity are near terms. Others such as the limited capacity of the atmosphere to absorb excessive emissions of Carbon without disrupting climate will have longer term effects.

## 2. THREE IMMINENT LIMITS

Many limits are closing in on the mankind: a) population numbers, b) scarcity of water, c) life-threatening levels of pollution, and d) food scarcity. Of all the constraints it is the supply of food that will determine the earth's population carrying capacity.

Three of the earth's natural limits influencing food production are: 1. Oceanic

fisheries, 2. Fresh-water, and 3. The amount of fertilizers that the existing crop varieties can effectively use.

The oceanic fisheries cannot sustain an annual yield of more than one hundred million tons. This limit was reached in 1989. Now all seventeen oceanic fisheries are being fished at or beyond capacity. The decline in the sea food supply per person will continue indefinitely.

Pollution and over-harvesting kill many inland seas and coastal estuaries, e.g. the Aral Sea, The Caspian Sea, the Black Sea and the U.S. Chesapeake Bay.

The amount of fresh water supplies from the hydrological cycle imposes limits on land-based food production. Today (1995) two-thirds of all the water extracted from the rivers and underground aquifers is used for irrigation. In parts of America and China, there will be a competition between agriculture and residential demands. Only limited potential exists to expand fresh water supplies for irrigation. In America and in India, the groundwater tables are now falling. Punjab (India's bread basket), Haryana, Uttar Pradesh, Gujarat and Tamil Nadu have seen water table dropping by one to several meters a year. Growth of industries/urbanization, etc. will divert water to non-farm uses.

The physiological limit on the amount

of fertilizer that current crop varieties can use is an even broader threat to world food expansion. Increasing fertilizer use simply does not mean increased food production. This is true of the major food producing regions such as North America, West Europe, and East Asia. Wheat, rice and corn varieties do not show any more increase in production when fertilizer use is increased. Thus, the phenomenon of the steadily rising fertilizer use to promote food output is grinding to a halt after four decades. The options now are: To expand the land base cutting down forests, or to breed better varieties of grains that are much more responsive to fertilizer.

### 3. THE ECONOMIC EFFECTS

The depletion of natural capital of forest range lands, top soil, underground aquifers and fish stocks - and the pollution of air and water have reached the point in many countries where the economic effects are becoming highly visible including a loss of output, of jobs and of exports. Some countries have lost entire industries.

Sea food demand exceeds sustainable yield. Pollution destroys productivity. As a result, sea food prices rise, jobs are lost and economies shrink. Better profitability enforces more catch killing the breeding population in the Atlantic for e.g. the bluefin tuna breeding dropped from 2,50,000 to 22,000 as a result of overharvesting.

Over-cutting forests is destroying the economy of Africa, Philippines and other countries. The claims on underground water supplies now exceed aquifer recharge rates. For farmers in northern India, where wheat and rice are double-cropped, the rate at which the water table is falling may soon force a shift to less intensive cropping

practices. Rice will be replaced by sorghum or millet. This will arrest the fall in the water table but food production will inevitably tumble down.

Beijing in China and 300 other cities there, Arizona and a number of cities in U.S. have switched over to ground-water from reservoir water or have switched over to less intensive rain-fed farming. In many places, the rate of ground water pumping is double the rate of recharge, ending in the total depletion of the aquifer. Aquifer depletion affects mostly rice cultivation, leading to lower rice stock. Japan resorted to emergency imports of rice in 1992 upsetting the rice market. How delicately the market is balanced? The world rice harvest is 315 million tonnes per year. Yet, a shortfall of 2 million tonnes could change drastically the market price of rice. It took two years for the price to stabilise. Asia produces and consumes 90 per cent of world's rice. Here growth has slowed down. One of the main reasons is shifting of irrigation from rivers to ground water. The rice varieties also have become insensitive to fertilizer use. Further, industrialisation has eaten away the cropland. Asia adds 5.7 million people annually and most of them are rice eaters.

Further, the world stocks held are decreasing. In 1985 the carry over stocks of world grains totalled 465 million tonnes.

A true flowering of humanity could occur only at a constant, modest, yet secure, level of consumption. It is possible to have better education, health, and quality of life without ever-

rising incomes. Perhaps, rather



Old  
lamps  
for new

than talking about "nil growth" or "negative growth-rates", which unnecessarily frightens people, we might begin to discuss "positive rates of reduction"; for that would suggest liberation from some of the burdensome, crippling, and indeed, suicidal, consequences of present ways of living.

**Winin Pereira and Jeremy Seabrook**





It was an all-time high and equivalent of 104 days of consumption. In 1993, it stood at 302 million tonnes or 59 days of consumption, a little more than pipeline supplies. With the carry-over stocks at such a low level, the world is now only one poor harvest away from chaos in world grain markets.

A World Bank study notes environmental damage including land degradation, pollution damage, loss of biodiversity, deforestation and soil erosion can cause one per cent to fifteen per cent of gross national product.

#### **4. UNSUSTAINABILITY FEEDS INSTABILITY**

The demand-supply relationship in sea-food, grains, etc. which have been stable for centuries or millennia are becoming highly volatile in the late twentieth century. There is a close relation between environmental scarcities, state capacity and civil violence. In other words, there is a close interaction of biological, economic

and political systems. Rwanda in Africa, Haiti and Somalia are only the tips of the emerging ice-bergs of economic chaos. The effects are:

1. Consuming the resource base itself instead of the product.
2. The predictability of economic responses does not work.
3. Instability in one field creates instability in other fields, for e.g. decline of sea fish catch has led to aqua-culture which consumes more grains.
4. When forests are cut for timber, or for clearing land for agriculture, rainfall drops.
5. When Carbon emissions by burning fossil fuels exceed Carbon fixation, the level of Carbondioxide in the atmosphere rises altering the earth's heat balance.

All these end in affecting political stability. And finally, the escalating demand for food in China could convert the world grain market from a buyer's to a seller's market.

*Summarised from: State of the World, 1995, Worldwatch Institute, W.W. Norton and Co., New York.*

## HOW MAN GOT WHERE HE IS NOW?

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SARALA DEVI

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**W**e have seen that the main difference between man and the animals is the development of intellect and emotion in man. Thus man can to some extent control the direction of evolution. But we have also seen that he has strayed from the path of social benefit into the morass of personal wants. This has hampered his powers of planning. The boomerang of the wrong direction of social development is now



threatening to return against him, and he is being enmeshed in his own net. Yet he still continues on the path of unplanned economic, political and industrial development.

His first advances were in the direction of reducing human labour by the invention of tools, but these inventions encouraged the cult

of individual benefit and public exploitation. The class differences of wealth and poverty (the haves and have-nots) arose. The law of the big stick became paramount. In feudalism exploitation passed beyond the limits of endurance. To escape from this unbearable exploitation the serfs migrated to the cities. Thus began the centralisation of industries in the cities. But here also there was no relief for the poor. The development of steam power also involved the power of capital. As a result of the need for capital in industry, the condition of the poor was no less pitiful than under feudalism. The problems created by the industrial revolution and the growing exploitation by rulers and capitalists led towards the red revolution, and the poor began to organise for their defence.

The growth of steam power revolutionised transport facilities and distant countries became next-door neighbours. As a result of the import of raw materials and the export of finished goods, economic conditions in the West began to improve. Thus labour organisation improved the conditions of labour in the West, at the expense of the exploitation of the backward

countries. Western labour therefore approved of this exploitation.

Increasing industrialisation implied complicated organisation. Many gadgets were invented to make the home life easy. It is simpler to open a tap for water or press a button for electric light than to draw water from a well and carry it home, or keep a flickering light burning. But these facilities imply a complicated organisation of life. The supply of raw materials imported from distant countries, such as fibres for cloth, food materials concentrates for cattle, the raw materials of industry, rapidly increased. Increased technology facilitated the extraction of geological treasures. The consumption of coal, iron and other minerals and ultimately of mineral oil, rapidly increased. The gap between the rich and poor broadened. At the same time, the labourers achieved facilities in daily life and therefore they tolerated this. The mechanisation of agriculture again brought an influx from the rural to the urban areas.

Slowly organisation brought some relief to the labourers in the towns, but at the same time, in this race of mechanisation they remained not the masters of but a cog in the machine. As a result of the race to obtain raw materials and dispose of finished goods, international conflicts arose, and these were "settled" by means of arms. Therefore the manufacture of arms also

became an important industry calling for both the investment of capital and for scientific inventions on a large scale. Thus this industry became a powerful interest in the control of politics. The creation of conflicts and wars became a powerful vested interest.

Man fled from the rural to the urban areas to escape from slavery, but here he became subject to a different type of slavery. In his anxiety to fulfil his increasing



personal requirements he became the slave of the machine, but also became the slave of a mechanical, social, political and economic organisation.

The masses tried to revolutionise ownership through communist revolution, but they made no attempt to revolutionise values or organisation, therefore in these countries also man still remains the slave of his increasing desires and of the machine, of the power of coal, steam, gas, electricity and ultimately of atomic power. His

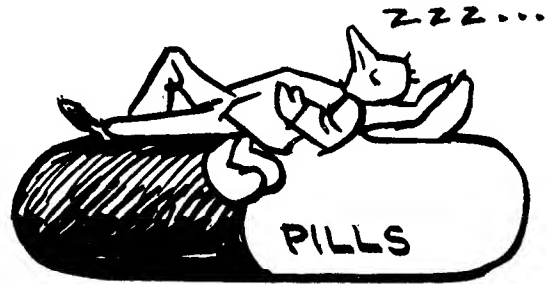
inventive powers have mainly been used to increase the horrors of war, for in all fields of discovery, scientists are selling their brains in the best market.

Now atomic power also is being used in the field of industry. The demand for manufactured goods regularly increases exponentially. This has led to the development of the advertising industry.

Radio and television are misused to lead the public into the delusion that industrialisation and the manufacture of synthetic materials have placed in man's hands the power to bring heaven down on to the earth. But automation and cibernation again brought the world face to face with a crisis of unemployment. Micro electronics are now accelerating this process. Man will again have to open new industries and seek new artificial markets to solve the problem.

We shall be unable to escape from this violent circle until the form of our organisation is revolutionised. But man is still intoxicated by this rage for ease and amenities. He is blind. He has not learnt to adjust to the atmosphere. He has not learnt to adjust with nature. He has not learnt to adjust with his neighbours. He has lost his powers to use leisure constructively. In the fields of industry and commerce he is of course the slave of the machine, but even in leisure he is enmeshed in the same lure.

Day and night he is harassed by noise. Many people want peace and quiet, but a radio fanatic keeps them awake. For the whole twentyfour hours now man's brain remains the slave of the machine. He cannot digest



**'SLEEPING' PILLS**

without pills, he cannot sleep without sedatives. On all sides crime is increasing. Man seeks escape in drugs and drink. In the effort to achieve the conquest of nature and to escape from his inner self, he is losing all peace and true prosperity.

But there is yet another aspect of this mechanical way of life which is attracting the attention of the public and of some specialists. This is pollution. We have seen that life on this earth became possible when certain gases attained certain definite proportions. Vegetation contributes oxygen, animal and plant life contributes carbon, to the atmosphere. The first interference in this cycle took place when man first conquered fire for use in his daily life. Fire smoke not only produces carbondioxide, but also carbon monoxide. This gas is fatal to man. Man progressed and with the development

of smithy and other primitive industries, he began to fell the natural forests indiscriminately. This decreased the sources of oxygen while increasing the source of carbon. With industrialisation, man began to consume carbon stored in the bowels of the earth thousands of years ago. This intensified the pollution of the atmosphere. Then followed the utilisation

of mineral oil and gas. As a result of increasing industrialisation, many kinds of dangerous wastes are discharged into the atmosphere and the rivers and oceans. So far, man has remained unconcerned in this direction.

***Source : Revive Our Dying Planet,  
Gyanodaya Prakashan, Nainital, 1982.***



## A NEW PARADIGM

SAILENDRA NATH GHOSH

**G**enuine democracy - embodying political, social and economic democracy - is conducive to all-round development, durable prosperity and universal happiness. A system that calls itself a democracy but lacks even one of these aspects is only a pretence. Depending on the enormity of the pretence, its subversive influence on development varies.

Both 'democracy' and 'development' are grossly misused terms. Mock democracies are called democracies, and maldevelopment is called development.

Abraham Lincoln's description of democracy as government of the people, for the people, by the people is accepted the world over as the standard. By this yardstick a system of governance exclusively by elected representatives, with little scope for people's direct participation in decision-making, does not deserve to be called democracy. Lincoln maintained that social equality is essential for democracy; his opposition to the system of keeping slaves was actuated by this concept. He also enunciated that the enthronement of

corporate interests and accumulation of wealth in a few hands meant an inevitable collapse of democracy.

A system which is biased in favour of, or against, any particular religious, racial or language group or even a caste is no democracy. It is bound to continually be at war with itself and hence unstable. Thus, the mere existence of an electoral process in which the people's role is limited to casting votes at periodic intervals is nothing more than a pale shadow of democracy.

In his final address to the Constituent Assembly, Dr. Ambedkar underlined the importance of the trinity—political, social and economic democracy for nurturing an ambience of liberty, equality and fraternity. 'To divorce one from the other is to defeat the very purpose of democracy'. 'Political democracy cannot last unless there lies at the base of it, social democracy'. About economic democracy, he said: 'We have (in India) a society in which some have immense wealth against many who live in abject poverty. This can only put political

democracy in peril.' Social and economic inequalities will certainly blow up the structure of political democracy. Two centuries ago, Thomas Jefferson, who drafted the American Declaration of Independence, had similarly pinpointed economic democracy as an essential condition for a republic.

By the above definitions, France, Germany, USA, UK, Canada, Italy - the G-7 countries - are no democracies, although they are loudest in making noises about it. The testimony of Woodrow Wilson, President of the United States (1913-1921), remains conclusive. Commenting on US democracy, he said: 'The masters of the United States are the combined capitalists and manufacturers of the United States. It is written over every intimate page of the record of the Congress. It is written all through the history of conferences at the White House that the suggestions of economic policy have come from one source, not from many sources... The government of the United States at present is a foster child of special interest.' For this he sought to curb monopolies, pushed through antitrust laws, brought constitutional amendments for direct popular election of US Senators and for giving women the right to vote. His reforms for curbing monopolies have since been reversed - washed away in the tidal sweep of capitalism's corporate centralism.

Clearly, without a fundamental change in the political, social, economic and technological philosophies and structures, it is not possible to reorient society towards genuine democracy.

Today's 'market democracies' surpass the exploitative aggressiveness of their previous incarnations. These are systems protecting the interests of the supranational mega-corporations seeking open access to raw materials and control over markets across the globe. The badge of democracy is only an instrument of deception. This is, in fact, a phase of insidious colonialism combining exploitative ruthlessness with the most beguiling of remote control devices embedded in offers of financial and technical assistance and promises of beneficial trade.

Even before this insidious phase, Gandhiji called representative democracy, unsupported by participatory democracy at the grassroots level, a sham. Experience has shown that such spurious democracy can take countries towards increasing divisiveness and disruption. This is more true of populous countries. In a two-tier federal system, even if considerable power is vested at the state-level, this would only give rise to state-level power centres. Legislative, executive and judicial powers must be constitutionally vested in the basic units too.

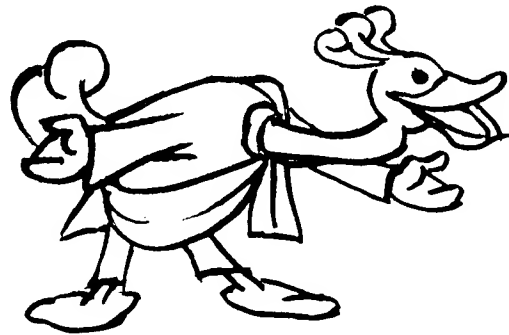
In representative democracies, under a multiparty political system, a blind allegiance to personalities breeds attitudinal rigidities and subservience to political parties. It shuts out reasoned, issue-based discourse and splits the country both vertically and horizontally. When partisan vote-seekers join the electoral fray, money becomes the mainstay and the competition for distribution of largesse encourages corruption. As against this, a representative - cum - participatory democracy would cement people's unity, keep up the momentum and quality of development and become a safeguard against corruption. Incidentally, our panchayati system which does not continually take its sanction from village assemblies and is dependent on the union or the state level government for its finances, is only a shadow of participatory democracy.

Now, to a definition of development. Development is an unfolding from within, a

DEVELOPMENT IS AN UNFOLDING FROM WITHIN -- FLOWERING OF THE INNATE POTENTIAL...



flowering of the innate potential. Hence it ought not to be confused with growth, which is merely a quantitative concept. Growth is uni-dimensional. Unbridled growth is cancerous. As against this, development is multi-dimensional: it involves processes of growth, differentiation, and evolution in successive stages. Even in the arena of material production, it seeks an increase in the totality of goods *pari passu* an improvement in the production base, that is, in the state of the soils, the water resources and the atmosphere.



MERE GROWTH WHICH SUITS BUSINESS INTERESTS MASQUERADES AS DEVELOPMENT

Today's tragedy is that mere growth, which suits business interests, masquerades as development. In a pursuit of material goods, GNP has become the index of material prosperity and the concept of material goods production, in turn, is now anchored in monocultural practices. An increase in a few select products is being



sought at the cost of undermining the production base and even the life support systems. Everything of value has been turned upside down in today's commerce-driven civilisation. In the economic sphere, what was tertiary (trade and services like banking, insurance, market information) has come to claim primary importance, and agriculture, the primary source of creation of real wealth, is now dependent on industry.

The shock of this topsy-turvydom made Professor Tinbergen, who propounded the concept of GNP as a measure of economic progress, bemoan that 'the use of GNP is steering the society with a wrong compass.' GNP gives, imperfectly and somewhat deceptively, a measure of the aggregate value of national goods and services. It conceals the distribution of wealth and gives a deceptive picture of social health. Since the computation of GNP is not accompanied by a computation of Gross Destruction of Basic Resources (GDBR) – soil degradation, pollution of water and the atmosphere, depletion of mineral resources, the entry of toxic wastes in the food chain, and so on – it is a faulty indicator of economic health. Similarly, balance of payments, in an export-led-growth system, gives a highly distorted picture of the internal purchasing power of national currencies.

Thus, prevailing economic theories and 'developmental' concepts have only been pushing the natural-resource-rich but long repressed countries of the South to economic ruination. The paradigm of development that the IMF and World Bank, and the newly added octopus of WTO, are forcing down the throats of exploited nations, serve the interests of the elite of the industrial nations (and their collaborators within the impoverished nations) who feel that a majority of the world's people – the 'skinny skeletons, the black subhumans' – should perish to make the world more liveable for the elite of the fair-skinned races.

The illusive impact of tendentious economic theories can be gauged from the following example. About forty years ago, a Marxist economic writer of Trotskyite persuasion gave the following exposition. 'Development,' he said is like a churning process, Churning differentiates butter from the rest of the milk. Development invariably throws up certain sections of the society as disproportionately rich, in whose hands capital accumulates. You cannot avoid it.' This is a concept of development in which social justice is kept in abeyance. That even some Marxists shared this concept of development is significant.

The kind of 'development' which took place in West Europe and later in the

USA and Canada is accepted as a model and an inevitable means to prosperity. That is why eco-destruction and common people's ruination with an icing of a thin layer of prosperity is called 'development'. The most unsustainable societies are called 'developed' and the world which will find no drinkable surface or ground-water in the next century is called the 'first world'. For such maldevelopment, counterfeit democracies, even dictatorships of different shades could be suitable.

Mahatma Gandhi had called into question the pattern that passes as development. He called it a 'dehumanising pattern wherein machines become the master of men.' He also raised the question: 'If as small country like England needs the world as a market, how many worlds would we need if we adopt the same pattern?' This question was over-looked by his followers when they came to wield power in free India.



IF ONLY 6% OF  
THE WORLD  
POPULATION  
RESIDING IN  
THE US HAS TO  
CONSUME 40%  
OF THE WORLD'S  
RESOURCES,...

The same question is now reverberating throughout the world, teetering on the brink of sociopolitical and ecological disaster. 'If only 6 per cent of the world population residing in the USA has to consume 40 per cent of the world's resources, then, on the same pattern, the world's population would need six and a half times this planet's resource.' Plainly, this is an absurd and insane notion of development.

But the finiteness of resources is not the only objection to this growth mania. What makes it lethal is the inter twining of all kinds of biophysical and biochemical imbalances with all manner of political, economic, socio-cultural and ecological evils into one web. A facet of this evil has recently been so powerfully manifest that even our health establishment has been obliged to point an accusing finger at the prevailing pattern of development. Faced with the phenomenon of one epidemic following another in an unending cycle, the Director of the National Institute of Communicable Diseases recently said: 'It is strange but true that we are paying the price for what passes as development' (*Times of India*, 20 October 1996).

The report goes on to say: 'One of the reasons for the upsurge of diseases is the deteriorating living conditions, particularly in big cities, often in spite of overall economic prosperity. Add to this the

effects on ecology resulting from development initiatives as dams and irrigation projects, human encroachments on forest areas, industrialisation and energy producing initiatives, and most importantly, unplanned urbanisation and excessive population growth... This is not to say that development should stop but the health component should be factored in planning such projects.' He was yet to see that if poverty eradication and health for all people are to be factored, we must reverse the direction of development.

Development guided by people's wisdom is different from one spearheaded by the privileged classes. The former favours nature - harmonic, hence people - friendly and inexpensive technologies amenable to local control. The latter, in the name of modernisation, opts for centralising, 'nature-conquering', technology-based grandiose projects in which contractors and professionals play a big role. It gives primacy to 'infrastructure' on the western model - express highways, mega power stations, proliferating chemical industries, airports, super-fast trains, computer networks, stadia and golf clubs, while behind the edifice, multiplying numbers of people decay in slums and tattered huts.

The other path of development aims at a steady rise in the standard of living of

all people, with the last person first in the order of priorities. It comprises high-yielding organic agriculture rich in bio-dynamic properties, decentralised electricity generation and renewable energy production for everybody's use, non-polluting industry and transportation; and housing, education and health for all. Such universally shared prosperity, in which there is no beggar and no super-rich, where the range of inequality is within conscionable limits depending only on merit, can only be achieved through genuine democracy.

Democratic development has no need for foreign capital which is a major instrument of exploitation in the hands of foreign investors. Of course, it believes in international collaboration in science, as distinct from courting the yoke of alien technology which is rooted in the principle of conquering nature and is dependency perpetuating. The upsurge of scientific and technological creativity from the ranks of the labouring people of Russia during the post-October Revolution days, gives the assurance that in a true democracy, the farmers, industrial workers and artisans will throw up *Michurins*, *Vavilovs*, *Sukachevs* and *Stakhanovites* galore. Indian farmers and workers have a high tradition of creativity in nature-harmonic ways (India's traditional agriculture was the most ecological and productive in the world before the British rule caused its destruction).

Democratic development eschews technology based on the principle of force for it knows that bounties can be obtained by understanding Nature's ways and cooperating with it. Money bag democracy seeks to apply force on man and nature, which eventually proves disastrous.

In a multi-religious, multi-racial and multi-lingual country, where multiple castes/denominations/tribes also exist within each community, psychic unity and a removal of the last vestige of social inequality must be the foundation of democracy. Diversities there must be, to enrich life and strengthen the mosaic of society. But these have to be rooted in unity. Without the subsuming urge for unity, diversities can be a game-plan for separatism. Harmonism is the name of a regime where none would have to risk loss of identity and none would have a licence for obsessive separateness to build barriers between oneself and the neighbours of other faiths.

Democracy provides spaces for pluralism of cosmogonic beliefs and rituals and promotes universal love. It enjoins protection of local flora and fauna as a sacred trust and instills into everybody the responsibility to make the habitat healthier and lovelier. This is in contrast to bourgeois democracy which implicitly believes that life on earth exists only for the enjoyment of the 'fittest'.

Genuine democracy recognises the importance of multiple loyalties to the family, locale of birth, the linguistic group and to the nation. It also recognises that all these loyalties can be harmonised. If any one of these vital emotions is sought to be repressed, it becomes perverse and seeks to overreach itself, introducing a whole series of other perversions along the chain. When legitimate emotions are accorded their rightful place, the outcome will not only be harmony and peace but also a high order of creativity.

Democracy's soul lies in the commitment to a lifestyle of simplicity. When simple living becomes a nation's ideal, the process of levelling up of the poor can



work. A failure to uphold this ideal encourages consumerism based on greed and unfair competition. It diverts resources to wasteful channels and makes the poor victims of the 'demonstration effects' of the

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rich people's 'conspicuous consumption'. Thus, it seeks to keep vast masses of the poor doomed for ever. On the other hand, a life of simplicity means consuming the least in quantity and the best in quality and organicity, consistent with the requirements of radiant health. Only this kind of lifestyle can leave ecological resources unimpaired and undiminished for future generations.

True democracy seeks the highest fulfilment of every individual, which is possible only through his/her concern about society's welfare. And the collectivity can be creative and prosperous only when the individual finds fulfilment in a climate of freedom. This close complementarity between the individual and the collective is the hallmark of democracy. True democracy's concern is for each member's individuality and fulfilment, as well as the collective's shared prosperity and mutually supported creativity.

Healthy nationalism is a prerequisite to democracy and a bulwark against

imperialism. This must not be confused with rabid nationalism (i.e. chauvinism) which keeps the country blind to the knowledge originated or experience gained in other countries. Healthy nationalism feeds and is fed by sub-nationalism on the one hand and internationalism on the other. Nationalism is the link between localism and universalism. Without its leverage people cannot be lifted from parochial localism nor can the high of universalism find a medium to become an accessible value for the common people. Democracy withers under the onslaught of imperialism without the protection of nationalism.

Democratic socio-economic development would seek to deconcentrate capital; deconcentrate land holdings; decongest habitat; decentralise industries; promote de-urbanisation and eliminate distinction between intellectual and manual labour in a social climate where each form of labour spurs the creativity of the other. Of these six streams of programmes, de-urbanisation needs some explanation. It must become a primary objective because urban growth pre-emptes resources and starves other programmes. The per capita expenditure on materials for an urbanite is about six times that on a rural person. The supply of water and electricity to high-rise buildings, drainage, sewerage, roads, lighting, the cross-haulage of goods and services to and from the towns account for this multiplier

in resource depletion. Urbanisation forces breaks in the nutrient cycles, a fundamental process of Nature. It causes high density of pollutants in industrial conurbations and make their cleaning a high-cost proposition.

Ironically, elitist democracy furiously promotes urbanisation. Such a 'development' will not succeed in improving the urban milieu either, because the starved rural areas will steadily push out more and more people towards the cities.

Since economic policies in a genuine democracy will necessarily be vastly different from today's globally dominant trend, their formulation and implementation will invariably depend on the strength of the people's will. This can crystallise and assert itself only if the structure of constitutional bodies is changed at the roots – that is, if a unitary or two-tier federal system yields place to multi-tier federalism. In a populous country like India, a five-tier federalism is necessary which means that constitutionally there need to be legislative, executive and judicial bodies at the levels of (i) cluster of villages (say, four or five villages); (ii) mini-block levels (say, units of 20 villages); and (iii) block levels (comprising 50-60 villages, too. Basic decisions concerning their own lives must be taken by assemblies of people – they should, themselves, for instance, discuss farming techniques, cottage industries, family-wise

consumption needs and availabilities, health care and disease prevention, education, and the estimates of resources needed therefore. For all these, the village assemblies must have legislative, including tax levying powers, instead of being 'hangers-on' to the district administration's disbursements.

This is a far cry from our present panchayat system which does not vest power in the people. Autonomy at different levels means multiple structures of shock absorbers as well as mechanisms reinforcing people's power. This is genuine self-determination at the grassroots level. Five-tier federalism implies clear cut delimitation of jurisdictions. For example, the Union government's jurisdiction may be limited to external affairs, defence and defence-related industries, foreign trade policy, currency, communication, space, nuclear energy research. Each level would be sovereign in its own sphere.

Two kinds of objections may be raised against this kind of decentralisation. One, that it would provide an opportunity to local despotism. Two, some fissiparous elements may raise their heads with a loosening of centralized control. Poor people's solidarity is the remedy for local despotism. Alongside, a vigorous movement to strengthen inter-cultural bonds

can create an ambience in which each linguistic or ethnic culture finds reciprocity in every other culture. This bonding, not centralism, is the basis of unshakable integrity. On the contrary, too much centralism provokes separatism. In sum, democracy needs a constitutional restructuring enshrining multi-tier federalism to empower people to take basic decisions.

Multi-tier federalism, however, cannot function if society's basic technologies are centralism – oriented. For example, there is no point in declaring panchayati raj if agriculture has to depend on chemical fertilisers, chemical weedicides/pesticides, irrigation water from trunk canals connected to big dams, and electricity generated afar. Each of these is beyond the control of the panchayat. In such a technological regime the panchayat can only suck its thumb. Democracy, therefore, needs a genre of technologies congruous with decentralisation. Nature-harmonic technology is local resource-use oriented. Conducive to people's economics, and amenable to people's control, apart from being non-polluting.

Democratic development has to give primacy to rebuilding the infrastructure of life. This means preserving the ancient forests plus reforestation of denuded mountain ranges, hills, wastelands and

planting trees on roadsides, canal sides and embankments of tanks. Forests are the base camp of oxygen-dependent forms of life's journey on this planet. Ironically, this basic fact is forgotten by 'modernist' planners who focus on building infrastructure for industry and commerce by destroying the infrastructure of life itself. Besides, forests are the foster mother of agriculture in perpetuity.

Without a strong support base of forests, there is little chance to revive agriculture. Protection of the ancient wildernesses is particularly important because their plant varieties may contain the genes needed for upgrading the fast-deteriorating hybrid crops introduced by genetic engineers. Yet another grim reminder of the importance of coastal forest – the mangroves – comes from the repeated cyclones in Andhra Pradesh. They are nature's agents for both saving the coastlands and heightening the productivity of coastal waters.

In the sphere of primary production (production of food, basic raw materials for clothing, housing, medicine and agricultural raw material for industries), people-oriented development would need a systemic approach. Productivity is at its highest when agri-horti-flori-pisci-sylviculture, poultry farming and animal husbandry are integrated as one system where the waste products of one become

the food for another. Poultry droppings and animal dung become the manure for cereals and vegetable production and fish culture. Floriculture, by attracting bees and other insects, steps up the pollination of vegetable and fruit plants. The stubble and straw fertilise the soil and serve as a mulch. Sylviculture fosters all crops. The trees' myriad roles have been mentioned above; their role even as a perch for birds which devour the crop-damaging insects is considerable.

This integrality makes available all the necessary inputs for the cultivars on the farm itself. Diversity becomes an insurance against pest multiplication. There is no need for chemical fertilisers and chemical pesticides, or for that matter any other external inputs.

A major difficulty in this integral approach is the small holdings of our farmers. In many areas, and overwhelming majority of farm holdings are less than half an acre. Rotation is possible in such plots but the scope for mixed cropping or poly culture is severely limited. To overcome this problem it is necessary that small and marginal farm-owners cooperate in joint farming.

As for the landless, a major reliance would be on rearing cattle and poultry and participation in agro-processing industries, pending redistribution of land. With the spread of biogas, the manufacture of solar

collectors, solar cookers, solar water heaters and cycle parts in the village, newer avenues of employment will open up. Restoration of irrigation tanks, re-excavation of canals, desilting of river beds, afforestation of hills and wastelands, enhancement of soil organic matter of all arable lands, herbal gardening, preparation of Ayurvedic medicines and so on would add useful assets to the community while creating jobs. This is in contrast to bourgeois democracy's creation of some jobs in factories while causing far greater ouster from jobs in the unorganised sector.

Democracy's litmus test is food sufficiency with an assurance of two square meals for the poorest. Hence production of wholesome food (as against today's poison-loaded foods) and its equitable distribution are the kingpins in its programme.

A widening of the nutrition base is important for both people's health and environmental soundness. In earlier times people used to derive sustenance from about 3000 items of food. Over the millennia, mankind's nutrition base has shrunk to only 150 items, of which 30 are major, of which, again, only 6 are staples. Many of the fruits, flowers and leaves which formed part of the villager's menu barely 60 years ago have become scarce due to our imitation of urban ways and concepts



of 'modernization'. In the interest of conserving bio-diversity in nature and improving standards of nutrition, the diversity in food needs to be restored. For this, every basic unit of our habitat must co-exist with forests.

Since energy is crucial to every form of economic activity, the refashioning of policies for energy generation and use will play a crucial role in democratic



ENERGY IS CRUCIAL FOR  
ECONOMIC ACTIVITY

development. The society must fix a ceiling and a floor for every individual's energy consumption. A policy of restraining consumption of fossil fuels, particularly petroleum, should be rigorously followed to prolong reserves. All possible measures need to be adopted to generate and use renewable forms of energy, barring hydel

from big dams which is ecologically destructive. Proven technologies exist for harnessing solar energy, wind energy, biogas and electricity from mini-and micro-hydels. Technocrats may claim that these forms of energy are not yet cost-competitive, but research will remove the shortcomings, and large scale production will bring down the costs. The discouragement by vested interests, namely the petroleum, chemical and electrical companies is one reason why research in these has not got an impetus.

There is yet another aspect which needs redressal. So far the practice has been to overestimate commercial energy requirements, particularly electricity. People-oriented development will need to estimate the demand from each major end-use sector and to ensure that a user-need which can be met by a low-grade form of energy would not be addressed by a premium-grade fuel. For example, cooking should not use electricity, and refrigeration and space heating/cooling should only use solar power.

In electricity planning, the accent has been on a national grid, that is on a geographic integration of its generation and use. Democratic development will lay emphasis on *on-site integration of different forms of energy*. This means, every village community will attempt self-

sufficiency by integrating biogas production (based on animal dung, human wastes and plant wastes), energy generation by solar collector, solar cooker, solar pond (wherever possible), photovoltaics, photosynthetic energy and hydels. This will totally alter the picture of dependence on multinationals for equipment supply, erection and commissioning of large power plants, and drastically reduce the cost of transmission, besides eliminating the vexed problem of frequent interruptions due to tripping and theft. This will help the growth of new industry at decentralised levels and make possible the use of power in the hamlets of the poor. For mini-hydel generation, run-of-the-river systems which do not require dams are eminently suitable. Mangal Singh, a farmer in Lalitpur district in U.P. showed that micro-hydel could be produced even with a gentle gradient, provided a large quantity of water was present.

Despite the multiplication of renewable energy output, fossil-fuel-fired electricity will continue to be in demand, though on an attenuated level. To meet this need, the technology of cogeneration (regeneration of steam simultaneously with electricity) is a must. Cogeneration demands that the generating units be small so that the pipeline (to transport hot water to hospitals, hostels, chilling plants, washeries, households) cost is minimal.

When the energy generation pattern changes so radically, from its centralist orientation to decentralisation proneness, everything else would change. The use of fluidised-bed technology which has varied uses, from domestic oven to furnace, has a great change potential.

In industry, the pattern which obtains in Nature's kingdom should be taken as our model. In Nature, whether in the animal or in the plant kingdom, the smallest are the largest in number and the largest are the fewest. In industrial patterning, small industries have to be ubiquitous, practically in every cottage and the largest should be allowed only where there is a decided advantage in their favour. There is a particular logic in this approach. An increase in size often leads to an exponential rise in its pollution-creating potential. On the other hand, the advantage which large scales yielded in terms of energy economy is fast vanishing on account of society's demand that 'the polluter pay the depollution costs.'

This means that integrated steel plants, petroleum refineries and petrochemical plants which acquired mega-dimensions in a regime where only marginal productivity of capital counted – the costs of water and air pollution were treated as external factors; damage to plant and animal life around were left out of account – would

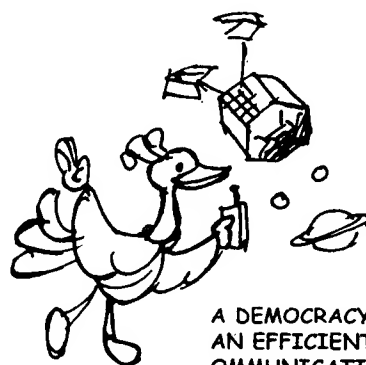
now have to internalise these costs. The overall *negative balance of benefits* that these show in a social accounting system would introduce a new concept of integration with the local economy and hence, of a scale where the cost and benefits to entrepreneurship will have to measure up to those of the society.

In housing, a pro-people development will stop the increasing encroachment of townships and luxurious suburban villas on arable lands. It will encourage the building of houses based on 'solar architecture' in which site-specific parameters, such as seasonal inclinations of the sun's rays and direction of wind become the prime factors. Insulation from heat and cold and the requirements of natural lighting is taken care of in the design of the house itself. Inexpensive mud-built or pre-fabricated houses with proper ventilation, sanitation and provision of airdraft under the thatched roof for cooling will come into vogue.

THERE IS A  
DEMAND FOR HIGHER SPEED  
IN TRANSPORTATION IN  
DEMOCRACIES DRIVEN BY  
COMPETITION



In transportation, too, democracy will bring a veritable change. Under bourgeois democracy, everything is driven by competition; hence the demand for higher speed in transportation. Low speed transportation has been pushed to near-obsolescence, even if it be the least consuming of commercial fuels, Bullock carts, small boats plying in canals and propelled partly by water drive and partly by man's muscle-energy are being replaced by diesel consuming road transport like 'tempos'. In contrast, genuine democracy recognises the need for low, medium and high speed transport. Since high speed transport (jet aircraft) has a high ecological cost, it should be restrained by deterrent tariff. In communication, however, a democracy must have an efficient



A DEMOCRACY MUST HAVE  
AN EFFICIENT SATELLITE  
COMMUNICATION SYSTEM...

satellite communication system. The more efficient the system, the more the saving on transport.

Education and health care are vast subjects. All that can be said here is that education under people's regime will be integrated with life so that secondary school students practicing agriculture, in their awakened inquisitiveness, will be able to imbibe – through their own practical work and enquiries – the basics of soil chemistry, soil biology, nature's nutrient cycles, geological principles, hydrogeology, plant pathology, entomology, along with a broad humanist culture. This integration with life's problems is the key to creative education. Student-teacher-farmer-artisan collaboration in a continuous learning-teaching process will open up a vista of generation and acquisition of knowledge in an animated interchange of roles.



THE DOMINANCE OF WESTERN MEDICINE WILL BE REPLACED BY EQUAL SCOPE FOR TRADITIONAL MEDICINE, TRIBAL MEDICINE, AYURVEDA, HOMEOPATHY, UNANI AND SIDHA SYSTEMS

Under genuine democracy, health care will give highest priority to pollution-free environment, nutrition plus vitality-building yogasanas for all. The dominance of western medicine will be replaced by equal scope for all branches

of medical science in which traditional medicine, tribal medicine, ayurveda, homoeopathy, unani and siddha systems will compete with allopathy. The present day separation of body from mind, the concept of disease as malfunctioning of a particular part of the 'body-machine', the dominant practice of extracting only the 'active principles' and leaving out important trace elements and other associated ingredients leads to mutation of disease organisms making them resistant to medication. The emphasis on hard technology, an over-use of drugs, excessive specialisation in medicare and the resulting phenomenon of steadily increasing incidence of doctor –induced diseases will be replaced by a more holistic view of health and medicare.

The approach outlined above to different aspects of development is diametrically opposed to today's dominant paradigm. Many will argue that 'when globalisation is the on going process the world over, we cannot afford to take to a wholly different pattern and face isolation.' There is a fallacy in this argument. To such advocates the world has become so small that a free flow of capital and unrestricted remittance of profits has become a must. But when it comes to movement of people, the world suddenly becomes so large that the rich countries insist on the freedom to raise

stiff barriers against immigration and wink at the growth of racism against the black people.

While discussing democracy and development, we must remember that democracy is now in grave peril. It must be rescued from the newest, most deceitful and ferocious imperialism. While talking enchantingly about 'free trade for everybody's prosperity' it is plundering the resources of the tropical and subtropical countries and even pirating the latter's plant, animal and human genes by myriad frauds. Phony democracy

will become increasingly menacing before being thrown into the dustbin of history. Democracy today entails greater costs than in the earlier struggles for freedom because large segments of the nations' elites have been inducted into the orbit of imperialism. The one redeeming feature is that a global opportunity has opened up for an alignment of all poor nations, together with the poor people within the rich nations.

*Courtesy : Seminar 451, March 1997,  
New Delhi.*



## MYTH OF "DEVELOPMENT"

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GUSTAVO ESTEVA

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*(The author shows that Mexico's experience in development, like that of all poor nations teaches that current approach needs change).*

For the last decade I have collaborated with several hundred "de-professionalized intellectuals" at the service of a network of 400 grassroots organizations in slums, villages and the boondocks. For these world's development has always been seen as a threat.

Most peasants are aware that development has undermined their subsistence on centuries-old diversified crops. Slum dwellers know that it has made their skills redundant and their education inadequate. If they do succeed in installing community life in the handmade shanties or abandoned buildings, bulldozers and policy - both at the service of development - will relocate them. Truly marginal groups know, how it feels to be pushed, inch by inch, into the cash economy.

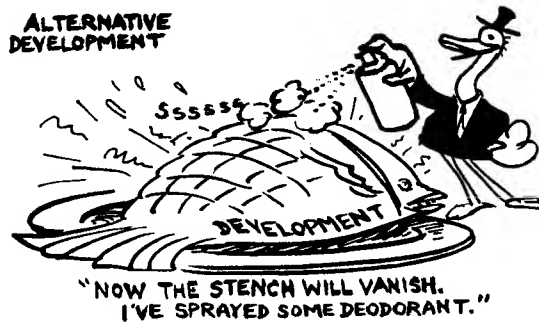
On the other pan of the education scale, sit an increasing number of ex-

economists and one-time sociologists or industrial managers, working at the grass-root level, who have had great difficulties in making their former peers feel the weight of what they have learned: no indicator can register the pain caused by the loss of self-reliance, dignity and solidarity the unmeasurable shadow of a quantifiable progress.

### QUESTIONING THE DEVELOPING DECADE

We have always classed the term "development" alongside other fuzzy slogans, like revolution and structural change. Recently however, a few of us have been tempted to present what we ourselves do as development. For within the last few years a net working establishment has come into being that travels around the world waving the banner of "Alternative Development." "Popular Participation," "Self Help," "Holism," "Networking," "Decentralization," "Local Control," "Low Energy Tools" are its slogans. I am confronted by those who, at home as well as abroad, wish to mask the stench of

"development" by using "Alternative Development" as a deodorant.



For a full generation development has been sacred and inviolate. It has been the common idol of sects, pursuing the same goal, albeit by incompatible means. The time has come to recognize development itself as the malignant myth whose pursuit threatens those among whom I live in Mexico. We ought to oppose the lease on life that a new "alternative" establishment promises. We can not ask US bureaucrats, or the new crusaders for alternatives, who derive their own dignity and incomes from the promotion of development, to take the lead. We must have the courage ourselves to demonstrate that the "three development decades" were a huge, irresponsible experiment that, in the experience of a world-majority, failed miserably.

In Mexico, the Rural Development Bank no longer contains sufficient funds to force peasants to plant sorghum for animal feed. As a result in many places, the return to traditional intercropping of corn and beans has not only improved

the diet but has restored some village solidarity - thus all - owing available cash to reach farther.

## YOU CAN PUT YOUR CULTURE INTO YOUR BALANCE SHEET

### An American Story

1. Divorce, crime, and emotional stress cause money and products to change hands and add richly to the GDP. The cost of emotional prop-up drug, Prozac, alone added 1.2 billion dollars to American GDP.



Listen

2. The cost of family breakdown 40.6 billion dollars per year.
3. Undoing the effect of over eating 33 billion dollars per year.
4. 70% of America's medical bills stem from preventable lifestyle related illnesses.

*From: The Hindu, by Rajan Bakshi*

## AWAY FROM MARKET ECONOMY

Production cooperatives are springing up and thriving in the very heart of Mexico City, thanks to the decreasing purchasing power of those formerly employed. Shops now exist in the slums that reconstruct electrical appliances. I have observed more than once how slum producers put their own name and address on a product because it inspires greater trust in the client. Neighbourhoods have come back to life, along with a phenomenal increase in next-door catering. In the midst of inflation, devaluation, so-called, unemployment and a decline in the economically defined national product, the majority of the people among whom I dwell are much better off than they have been for years.

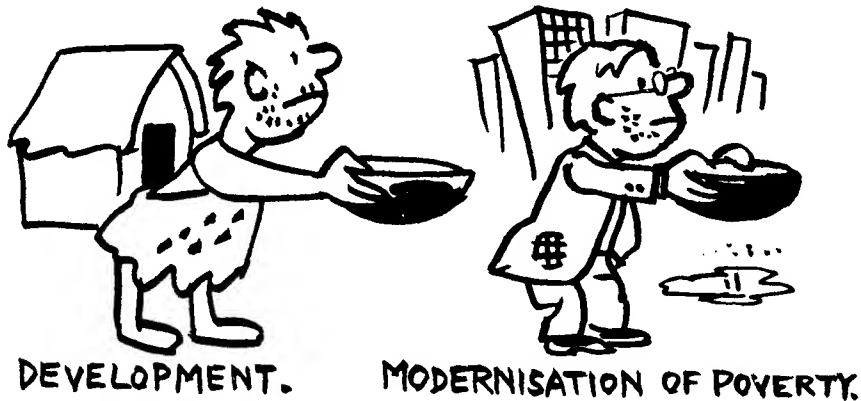
One of the contributing factors to this sense of well-being is a closing gap

between those who were formerly hurt by development rates and those who were favoured for a while by this growth.

Even among the intellectuals, a growing number have welcomed the demise of the development myth and helped disintoxicate official policy-making: so long as development is pursued, we will never be able to deal reasonably with our debt.

## MODERNIZATION OF POVERTY

As the definitions of development became more varied and contradictory, its connotations become stronger. Development means to have started on a road that others know better, to be on the way towards a goal that others have reached, to race up a one-way street. Development means the sacrifice of environment; solidarities, traditional





interpretation and customs to ever-changing expert advice. Development promises enrichment; and for the overwhelming majority, has always meant the progressive modernization of their poverty: growing dependence on guidance and management.

Mexico's predicament, which others call crisis, we herald as a chance. It is our

chance to slip to others, who are now forever out of a job, the ten thousand tricks by which we have used and abused modern techniques. It is our chance to delink well-being from development. I would like others, who are not as lucky as Mexicans, to be able to follow our reasoning.

*Courtesy : Science for Villages, Wardha, Dec-Jan. 1986.*



## SUSTAINABLE TRADITION

One day, Akbar and Birbal were on their rounds of the country, of course, in disguise.

In a village, they found a very old man bent with age with his limbs shaking, planting a sapling of mango.

Surprised at his venture, Akbar approached him and enquired of him. "O sire, your action appears quizzical. You are very old and at this age you are planting a sapling. Do you hope to live to eat its fruits?"



The old man replied, "The world does not work that way, my son. My father planted an orchard of mango trees. I enjoy the fruit. I plant trees. My son will enjoy the fruits. That is how actions that take long periods to fructify are carried out."

"The day everyone thinks that he will eat the fruit of the tree that he plants, otherwise he will not plant a tree, no one will plant a tree. No one will be able to eat mangoes either. In my family trees link generations."

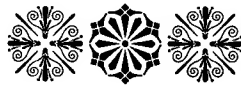
Surprised and happy at the old man's wisdom, Akbar revealed himself as the emperor to the old man and gifted him with a bag of gold coins. "The whole country should benefit from your wisdom, Sir", said Akbar.

The old farmer laughed and said, "See, a good act is not only its own reward. It brings external rewards too. My father planted a sapling of mangoes and it took thirty years to yield a fruit. I planted one today, and now itself I have a fruit".

Akbar was delighted that the old man's wit matched his wisdom. He gifted him with another bag of gold, now a reward for his spoken word.

The old farmer won't be put off.

He said, "Mango trees normally yield fruits once a year, or once in two years. Mine appears to be a special type, giving two crops in a single day". Laughing, the emperor left the place wondering at the old man's wisdom.



## **SUSTAINABILITY**

### **BASIC PREMISES ON WHICH THIS STRATEGY IS BASED**

1. The fundamental cause of poverty in India arises out of the scarcity of biomass resources to meet daily basic needs like food, fuel, fodder, manure, building materials and artisanal raw materials, almost all of which are biomass-based.
2. The growing ecological imbalance is further exacerbating this scarcity of vital survival needs.
3. The key objective of rural development programmes must be to restore ecological balance and increase biomass production on a sustainable and equitable basis.
4. Since India's landmass is made up of extremely diverse ecosystems, biomass productivity can be increased on a sustainable basis only if rural development programmes were to become ecosystem-specific.
5. Action will be best when it is planned and undertaken at the level of the settlement. If action is executed at any other level, people's involvement will be limited.
6. For them to act, all rural settlement must have an active institution which has legal control over its immediate environment and access to funds. The role of the government must be that of an enabler of village - level planning and action, rather than that of a doer.

**EACH RURAL SETTLEMENT OF INDIA MUST HAVE ITS OWN CLEARLY AND LEGALLY DEFINED ENVIRONMENT TO PROTECT, IMPROVE, CARE FOR AND USE.**

**THAT IS THE ONLY WAY INDIA CAN BECOME RICH AND GREEN.**

*From : Towards Green Villages, Centre for Science & Environment, New Delhi, 1989.*

## THE SOCIAL DIMENSION OF SUSTAINABLE DEVELOPMENT

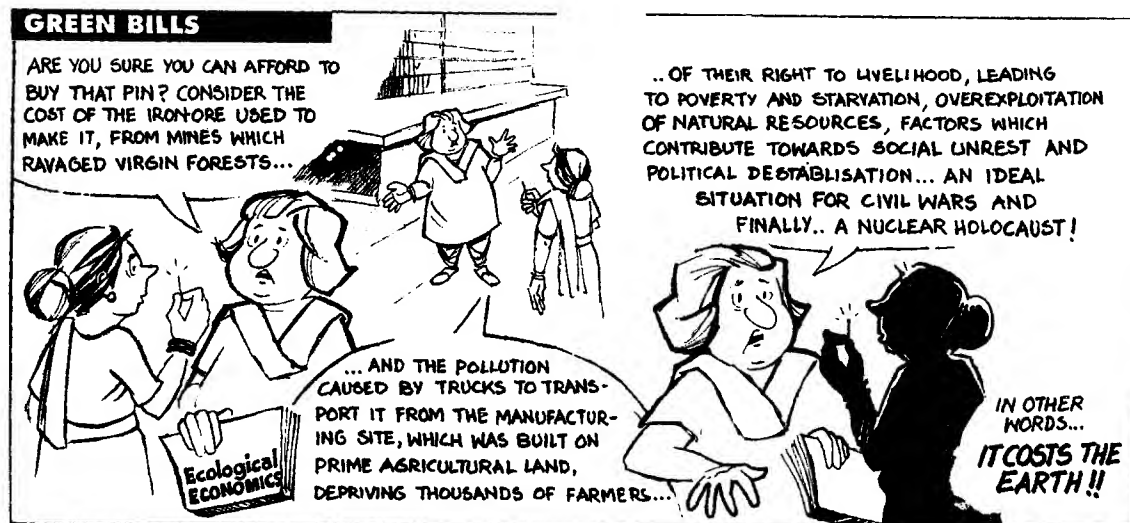
ARDHENDU S. CHATTERJEE

**P**resent development models are unjust and unsustainable because they are based on a series of false assumptions about nature, human beings and their interrelationship. Some of these false assumptions are :

(i) Nature is a resource for humans. The more we can dominate it, the better we can satisfy human needs. Things which are of no direct value to humans need not be bothered about and often need to be eliminated.

(ii) Growth is the prime mover of development. Satisfaction of human needs requires more of everything, therefore more is always better; what is good for business is good for the nation, and for humanity.

(iii) For every problem there's a technological solution. The average person cannot (and should not) try to understand these complex techniques. Experts know best and can always come up with a solution if sufficient money and more power is given to them.



Some of the basic assumptions of such development would have to be:

(i) Human beings must learn to live in harmony with nature. All natural things have intrinsic worth. By destroying biodiversity we reduce our own chances of survival, both physical and metaphysical.

(ii) Quality is as important if not more so than quantity. The earth is precious and her supplies are limited, hence we must tread carefully and make a conscious effort to minimize our impact on all living and non-living things.

(iii) Technology is not born in the minds of experts. Technology is a product of human interaction with nature. People know best their own needs and resources, and only a decentralized/bioregional planning approach can result in sustain and low impact appropriate technologies which are creative and meet real human needs.

The social implications of this world view can be summarized as:

Development planning and administration must be done on a human scale (small bio-regions) not in a centralized, compartmentalised, expert centered fashion.

Development goals must be articulated in specific terms and not for average populations. Who will benefit and how, should be clearly defined.

The development process must respect cultural differences. Minority traditions should be respected rather than imposing consumerism.

The development process must be open, accessible, participatory and discuss the costs and benefits of various options in the short and long term.

The goal of Sustainable Development is to improve the quality of life. In a 'developed' society everyone should have the opportunity of doing 'happy work', work that is productive, regenerative, creative / recreative, meaningful, holistic.

Our dreams of peaceful and sustainable societies can be realized only when we are ready to accept our human limitations and recognize that inner needs - i.e. goals of emotional and spiritual development - are not separable from goals of economic and social development.

***From : Integrated Approach towards a Sustainable Future, Centre for Scientific Research, Auroville.***

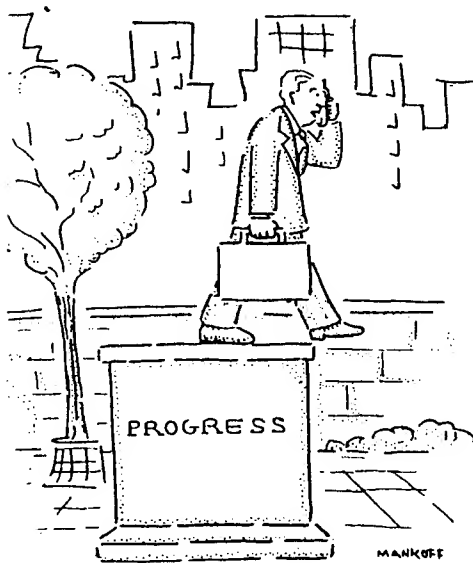
## THE ROLE OF THE BUSINESS COMMUNITY IN SUSTAINABLE DEVELOPMENT

JAMSHYD N. GODREJ

An essential prerequisite for economic development in any country is a viable industrial base. Industry and business do not just provide goods, services, employment, etc.; they also generate national wealth and sustain economies. Paradoxically, industry is also touted as the one directly responsible for much of the pollution that degrades the environment. The current pattern of industrial activity - which alters the natural flow of materials and introduces novel substances into the

environment - has had a wide range of direct and indirect effects. It is also feared that the degradation of the environment would soon reach a threshold beyond which it would destabilize the ecosystem and alter planet-wide patterns. Therefore there is a need to change the overall metabolism of industry.

Any serious effort to pursue sustainable development globally must inescapably perform the formidable task of transforming industrial practices. If industry is to provide for today's and tomorrow's needs without undue environmental degradation, new processes that use fewer resources and produce markedly less pollution or waste per unit of product have to be developed. In India, and for that matter, all over the world, concern for the environment till recently did not extend much beyond looking 'green', may be catering to the latest consumer fad or bowing to the next regulatory hurdle. It is only now that an increasing number of companies of all sizes are endeavouring to reduce the environmental consequences of their



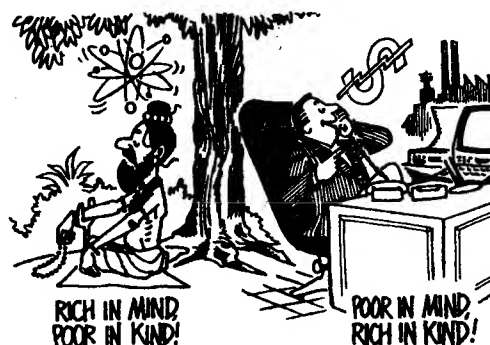
operations, right from resource extraction and production to final delivery of the product.

A gradual change in the business environment is being witnessed today. Changing the business environment is integrating industrial processes and products with the larger industrial ecosystem where material flow loops would be completely closed and would eventually become economically and environmentally viable. Today, few would believe that this is possible, but it could very well become a standard in the years to come.

Environmental stewardship these days is being viewed as a business opportunity rather than an additional cost. The convergence of environmental and business goals has already brought about tangible benefits with companies saving tens of millions of rupees in material energy, waste disposal and pollution control costs. Forward-looking companies have begun to realize that minimizing overall waste and emissions is a key to maximizing productivity and sustainability. Eco-design of products and processes is fast emerging as a tool for shoring up both environmental acceptability as well as competitiveness and profitability. One can now categorically say that the second

industrial revolution is in the making, albeit slowly.

The rising environmental consciousness amongst consumers, largely due to efforts of concerned groups, is another factor influencing businesses to



adopt these practices. Today, the stakeholders for a company are not only shareholders and lenders, but also employees, customers, trade and industry association, non-governmental organizations (NGOs), the common man and, in a much wider sense, future generations. The movement therefore by certain companies to extend their clean-up efforts beyond regulatory compliance is an important beginning. Widespread adoption of this attitude, partly as a result of educational and media efforts, has been, and will be, a substantive part of any move towards sustainable development. Without the active and cooperative participation of business, media and the community at large, overall



progress would be difficult despite increasingly strict environmental regulations.

Success in transforming industry, through new technology, innovative design and better management systems, depends largely on realigning global markets to support sustainable development. The direct implication is that products must be priced at the full environmental cost of their production. While the logic is simple, the actual implementation is not. All efforts of industry will be fruitless unless there is governmental involvement in adjusting tax and regulatory policies to intervene in markets on behalf of the environment. Regulations in the past were of the form of control and command, and thus narrow in their perspective. It is only now that governments are shifting towards policy mechanisms that are market-driven and proactive in nature. Financial institutions

also need to contribute by incorporating environmental concerns in their investment and leading policies.

The goal of industrial sustainability entails more than just technological transformation and application. It involves a fundamental paradigm shift in corporate culture and mindset. Transformation towards sustainability must begin in the boardroom. Without a change in the mindset of the top management, any effort would be rendered largely reactive and based on short-term compliance. It is the responsibility of the chief executive to bring about an ecological turnaround in the company and then use it to generate an eco-wave across industry and business.

***Source : Steering Business Toward Sustainability, Edited by Fritjof Capra & Gunter Pauli, The United Nations University, Tokyo, 1995.***



## THE STORY OF A MAN WHO ISOLATED HIMSELF

**K**ing Vikramaditya in a fit of anger imprisoned Kalidasa for some liberty the poet once took with him. Along with Kalidasa was a prisoner Bhukkundu who was condemned to death in a case. As the day of execution approached, the panic stricken Bhukkundu sent an appeal to the king in the form of a poem. The poem in Sanskrit when translated read: "Bhatti the wise brother of Vikramaditya is dead. Bharavi the great Sanskrit poet is also no more. Bhikshu, the Buddha has attained nirvana-samadhi and has died. Bhimasena the mighty Pandava has died. Next is Bhukkundu on the line. If I too die next will be Bhoopati, yourself O king! Because Yama the blind god of death

appears to choose his victims in the order Bha, Bhaa, Bhi, Bhee, Bhu, Bhoo...etc."

Sensing the hand of the immortal poet Kalidasa in this poem, the king enquired and found that the poem has come from his stylus and laughing the poet's crime away, pardoned him.

The death of dinosaurs, tigers, bustards, elephants, the lengthening lists of endangered species, increasing protective parks, tell man that he is somewhere in the list, somewhere in the queue of endangered species. What happens to mangroves today may as well happen to man tomorrow.



## EDUCATION AND TRAINING FOR SUSTAINABLE DEVELOPMENT

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MADHUKAR B. NISAL

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Most people in the world seem to believe that the educational system from primary to Ph.D. is too expensive, too cumbersome, and not, on the whole, very



effective. They believe that it needs radical reforms. The education of the coming century has to do with the human survival. The generation now will have to do what we, the present generation, has been unable or unwilling to do: stabilize a world population which is growing at the rate of a quarter of a million each day, stabilize and then reduce the emission of greenhouse gases, which threaten to change the climate - perhaps disastrously, protect biological diversity, now declining at an estimated rate of 100 to 200 species per day, reverse the destruction of rainforests, now being lost at the rate of 116 sq. miles or more each day, and conserve soils, now being eroded

at the rate of 65,000,000 tons per day. (The future generation must learn how to use energy and materials with great efficiency. They must learn how to utilize solar energy in all its forms. They must rebuild the economy in order to eliminate waste and pollution. They must learn how to manage renewable resources for the long term. They must begin the great work of repairing, as much as possible, the damage done to the Earth in the past 200 years of industrialization. And they must do all of this while addressing worsening social and racial inequalities. No generation has ever faced a more daunting agenda because the crisis we face is first and foremost a crisis of mind, perception, and values. We have to prepare people for lives and livelihoods suited to a planet with a biosphere that operates by the laws of ecology and thermodynamics.)

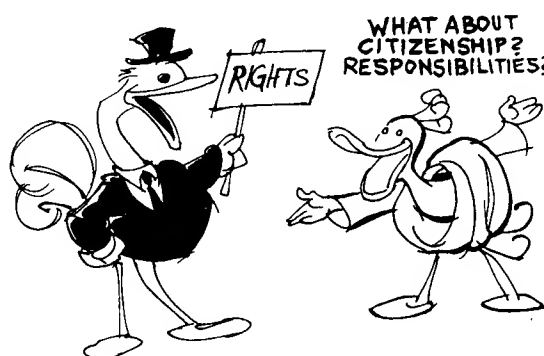
Looking ahead to the next century, for sustainable development we will require dismantling the jerry-built scaffolding of ideas, philosophies and ideologies that constitute the modern curriculum. Five measures are necessary to do this. First,

we must develop more comprehensive and ecologically solvent standards for truth. The architects of the modern world view, notably Galileo and Descartes, assumed that those things which could be weighed, measured and counted were more true than those which could not be quantified. If it couldn't be counted, in other words, it didn't count. Cartesian philosophy was full of potential ecological mischief, a potential Descartes' heirs developed to its fullest. His philosophy separated humans from the natural world, stripped nature of its intrinsic value, and segregated mind from body. Cartesian science rejects passion and personality but, ironically, can escape neither. Passion and personality are embedded in all knowledge, including the most ascetic scientific knowledge informed by the passion for objectivity. Descartes and his heirs simply had it wrong: there is no way to separate feeling from knowledge, or object from subject: there is no good way to separate mind or body from its ecological and emotional context. It may even be the case, as some are coming to suspect, that intelligence is not a human monopoly. Science without love can give us no good reason to appreciate the sunset, nor can it give us any purely objective reason to value life. These must come from deeper sources.

Second, we must challenge the hubris buried in the 'hidden' curriculum which

assumes that human domination of nature is good, that the growth economy is natural, that all knowledge, regardless of its consequences, is equally valuable, and that material progress is our right. Because we hold this belief, we suffer a kind of cultural immune-deficiency anaemia that renders us unable to resist the seductions of technology, convenience and short term gains.

Third, we must address the fact that the modern curriculum teaches a great deal about individualism and rights but teaches



little about citizenship and responsibilities. From the modern perspective we should see clearly how utterly dependent we are on the wider community of life. The word "patriotism", for example, is devoid of ecological content.

It must come to mean the use made of land, forests, air, water, and wildlife. To abuse natural resources, to erode soils, to destroy natural diversity, to waste, to take

more than one's fair share, or to fail to replenish what has been used must some day come to be regarded as unpatriotic. And 'politics' should be, as Vaclav Havel says, serving the community and serving those who will come after us. Our notions of citizenship and politics are anaemic, enlarge measure because our language has been corrupted by those who have stood to gain a great deal if words could be compromised. The primary task of teachers for sustainable development is to restore integrity to language in order that we might reclaim the commonwealth that rightfully belongs to all of us.

Fourth, we must question the widespread assumption that our future is one of constantly evolving technology and this is a good thing. Those who call this faith into question are dismissed as Luddites by people who know little or nothing about the real history of Luddism. Faith in technology is built into nearly every part of curriculum as a kind of blind acceptance of the notion of progress. When pressed,



THE UNCONTROLLABLE TECHNOLOGICAL JUGGERNAUT

however, true believers describe progress to mean not a consciously chosen path but a mindless, uncontrollable technological juggernaut moving through history. This technological fundamentalism needs to be questioned. Is technological change taking us where we want to go? What effect technology has on our imagination and particularly on our social, ethical and political imagination? And what net effect does it have on our ecological prospects?

For sustainable development we need an ecological imagination with which we can envision restored landscapes, renewed ecosystems, and whole people living in a whole biosphere. Yet in a technological age it should come as no surprise that our imagination is increasingly contained to technological possibilities faster and more powerful computers, television, visual reality generators and genetic engineering. Research in this direction stands in sharp contrast to our real needs. We need decent communities, good work to do, loving relationship, stable families. Our needs are those of the spirit, yet our imagination and creativity are overwhelmingly aimed at things.

There is a fifth challenge looming on the horizon, one which strikes at the oldest and most comfortable assumption of all: education can take place only in "educational" institutes. Colleges and



THE GRIP OF COLLEGES OVER EDUCATION WILL BE BROKEN WHEN ALTERNATIVES ARE DISCOVERED -- THAT ARE CHEAPER, FASTER AND BETTER ADAPTED TO ECONOMIC REALITIES

universities are expensive, slow-moving, often unimaginative and weighted down by the burdens of self-congratulation and tradition. They offer a discipline-centric curriculum that corresponds modestly with reality. The grip colleges and universities now have on "education" will be broken when young people discover alternatives that are for cheaper, faster and better adapted to economic realities.

For sustainable development five basic ingredients are required. They are Gaia, Deep ecology, Permaculture, Bioregionalism and Creation spirituality.

① Gaia is a scientific explanation for understanding the Earth. The majority of the scientists do not see the whole Earth as one living organism, or as an interdependent and interconnected whole. But the Gaia hypothesis is changing that. For example, my body is one system. On the top of my

head I have my hair which is totally connected with the toe-nail in my foot. Similarly the whole Earth is one body - Gaia.

The Sanskrit scholars of India believed in *Vasudhaiva Kutumbakam*, which means, *the whole Earth is one family*. So a tree is not a utilitarian object to build a house with, or make furniture. A tree is a member of my family. Even a worm in the earth is not merely a creature to create nice soil for the food to grow. The worm is a member of my family. If we have that kind of thinking, we will not upset the



THE TREE IS A MEMBER OF MY FAMILY

balance of the Earth, we will not destroy the fabric of nature.

Gaia is an emotional experience as well as a scientific discovery. It is a poetic expression as well as an intellectual concept. Scientist and ordinary people can relate to Gaia equally. Everyone knows that we depend on each other, not only on human beings, but

we depend on the worms too. If worms were not in the soil working for us, we would not be alive, we would not be able to speak, we would not be able to stand. Whenever we eat our delicious meal we must thank the worms, without which the food would not grow.

2 Once we have understood that the whole Earth is one interconnected entity, then Deep Ecology becomes the next step. The Gaia hypothesis will not be of much use without realizing that everything upon this Earth has intrinsic value—a tree, a worm, a river, all and everything are good in themselves. The tree is good not because it will make nice furniture, or a nice house, or a nice firewood. These are all useful but secondary aspects. The most important thing is that everything upon the Earth has deep intrinsic value, all things, maintain a deep intrinsic relationship to each other. They are good in themselves. We have no right to think that we human beings are more important than, say, rainforest.

The well-being and flourishing, of human, nonhuman life on Earth has value in themselves. These values are independent of the usefulness of the nonhuman world for human purposes. Richness and diversity of life forms contribute to the realization of these values and also values in themselves. Humans have no right to reduce this richness and diversity except to satisfy 'vital' needs. The flourishing of human life and cultures is

compatible with a substantial decrease of the human population. The flourishing of nonhuman life requires such a decrease. Present human interference with the nonhuman world is excessive, and the situation is rapidly worsening. Policies must therefore be changed. These policies affect basic economic, technological and ideological structures. The resulting state of affairs will be deeply different from the present. The ideological change is mainly that of appreciating 'life quality' rather than adhering to an increasingly higher standard of living.

3 In short, Deep Ecology is 'activism' on a 'spiritual' basis. (Once we accept that Gaia is good, how do we interact with it? We human beings need food, we have to cultivate land, we have to fulfil our vital needs. We have to take some trees to build our house, we have to take water from the river, we have to make clothes, we have to make fire to keep warm, we have to breathe air, we have to use animals. What is the guiding principle upon which our relationship with Gaia is determined? That principle is "permaculture", a culture of permanence of sustainability.

Whether we are in business or farming, in politics, or industry, permaculture is applicable in every field. The idea of permanence is very much an old idea. The American Indians believed that whatever you do, remember how your



"REMEMBER HOW YOUR ACTION  
IS GOING TO AFFECT THE  
SEVENTH GENERATION..."

action is going to affect the seventh generation. Permaculture helps us to think of posterity, of our children and great great grand-children, how they are going to be affected by what we do today. So we cultivate the land, we make goods, we run our economy, we run our business – we need to design all our activities in such a way that all designs for living contain the idea of permanence. In the back of our minds we need to keep the question "is it sustainable" ? The economics of permanence is Permaculture.

People who are involved in Permaculture in some countries have been generating work within the community. Instead of a whole lot of people making air - conditioners or Refrigerators that become obsolescent in ten years they have been developing durable work and exchanging a whole range of goods and services. Things

like LETs system and Community Enterprises Development Associations, which provide assistance for people to set up small businesses, have been started. Permaculture is for more local autonomy so that people can make their own decisions locally. Permaculture is for personal empowerment. It is giving people back the choices for themselves; and if we allow people to do that, we will have a flourishing local economy.

④ Now, once we accept that our relationship with the Earth should be based on the principle of permanence, we need a sense of the place. The Earth is a large planet. Can we depend on the cheese from Denmark, coffee from Kenya and tea from Sri Lanka? Japanese cars are exported to all countries and American cars are exported to Japan, is this sustainable? Here we have the idea of Bioregions. Mahatma Gandhi called it by other name "Swadeshi". Bioregionalism is a decentralised, locally-based economy.

Whatever things can be made locally and produced locally, we should use them first, and things which cannot be produced in our immediate locality should be imported from nearby neighbourhoods and districts. If they are not available within that area and we still need something and if it is a vital need, may be we should get them from within a nation. If we still need a few



things - but only very, very few things - then we might get them from within a continent. But free World Trade is neither ecological nor sustainable - the amount of energy, the amount of bureaucracy, the amount of time, the amount of administration spent on import and export of goods is wasteful.

We are always chasing the foreign market. Governments always say that the only way to develop and strengthen the economy is to find the export market - but what about the home market? They forget it, and they are chasing a competitive market abroad. A bioregional economics is complementary to the concept of good and durable Gaia. Big institutions cannot be sustained in an ecological world.

Gaia, Deep Ecology, Permaculture and Bioregions are practical ideas of an integrated view of nature. But the world cannot be sustained by practical ideas alone. It also needs the spirit. If we do not have a place for the spirit, we will lack meaning. Therefore creation spirituality which helps to develop a sense of the sacred is an essential part of an ecological world view, for sustainable development. What does Creation Spirituality mean? It is not a religion, it does not mean that you have to go to church, a temple or mosque to read Bible or Gita or Koran. It means that the human soul and the soil are imbued with the divine principle).



Creation spirituality helps us to see nature and ourselves differently. Earth is sacred, trees are sacred, rivers and mountains are sacred. If we have that sense of sacredness, then we will never be able to pollute or destroy or deface nature, because of our attitude of reverence). The modern industrial society doesn't have that sense of reverence for nature, resulting in the pollution and degradation of the Earth. The Crisis of Sustainable Development comes out of utilitarian, materialistic, non-sacred, non-spiritual world view - "The Earth is there for us to use, for our comfort, for our convenience". As a consequence we take from nature without knowing any limits. When we have a sense of reverence, we shall take from nature only to meet our vital needs. And when we take something, we thank, we show our gratitude - like we take milk from the mother's breast, the mother is very happy to give her milk in the same way as the Earth is happy to give its fruits as long as we take only what we need.

When the baby is full he or she stops, doesn't go on sucking. Well, unfortunately we humans go on sucking from the Earth. Mahatma Gandhi said "There is enough for everybody's need in this world, but not enough for anybody's greed". So need and greed have to be differentiated for sustainable development. How can we differentiate them? A government cannot legislate it. A dictator cannot force it. It has to emerge from our own individual heart, from a sense of beauty, a sense of divine. When we have that, then we take things from the Earth for sustainable development and always replenish what we have taken.

Finally, I like to add a word about the goals of training, and education for sustainable development. We ought to encourage our students, while training and educating for sustainable development to find their calling in good and necessary work. The best and necessary work for our age involves in a thousand ways the recalibration of humanity's values, institutions, behaviours and expectations with those of the Earth. This is the task of training and education for Sustainable Development in our times.

***The author is President, Nisarg Sewa Sangh, Nagpur, India.***



## **THE PROBLEM OF SUSTAINABILITY IN THE LIGHT OF SOME EXPERIENCES**

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### **IT IS NOT BREAD VERSUS ENVIRONMENT; IT IS BREAD AND ENVIRONMENT**

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**A**part from industrialised economies where agricultural production has peaked, and Green Revolution countries where high inputs have increased food output (but destroyed the environment) there is a third category.

Nearly 200 crores of people, one third of the world's population have not been touched by modern technology. They live in poorer countries; with little foreign exchange to purchase external agro- inputs.

Their agricultural systems are complex, diverse. They live in humid, semi-humid low lands, hills and mountainous drylands. There the rainfall is unpredictable. These people are ill served by roads and facilities. Their agri-productivity is 10% to 20% per ha. of Green Revolution lands.

It is in these lands that Sustainable Agriculture has had the greatest impact

on local food production, doubling, or trebling food yield with little or no external inputs.

This regenerative agriculture has proved that it is possible, and possible with wider benefits.

The success stories have three elements in common. Everyone can learn from them. 1) Locally adapted resource conserving technologies, 2) Coordinated action by local group communities, 3) Supportive external Govt/NGO institutions helping farmers.

This success has been achieved despite the pro "modern", pro-urban, anti- sustainability, anti-poor policies of many governments.

When policies are reshaped, these people will help widen the base of sustainable agriculture.

## STEERING BUSINESS TOWARD SUSTAINABILITY

**B**usiness activities are responsible directly or indirectly for most human impacts on the earth's eco-systems and business operations today are conducted with too little thought as to their sustainability - that is, the satisfying of our own needs without diminishing the chances of future generations. The term sustainability which has both ecological and social components poses business an inescapable challenge. Without sustainability, there will soon be no more profits. Hence business people have

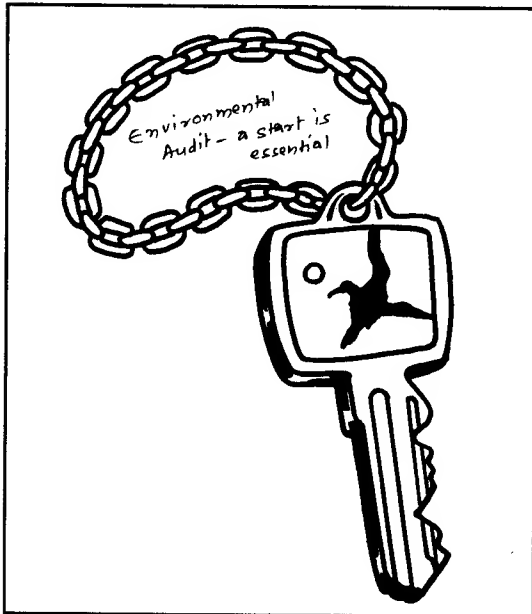
a strong self interest in minimising the ecological damage of their operations.

Much of the driving force for change in business comes from outside, particularly, NGOs that marshal, ecological and political expertise, educate the public, bring political pressure to bear on the government and outline new and often profitable possibilities for business.

Various professional services and groups assess and help to improve the environmental performance of a wide range of large corporations.

Social change takes place within the interplay among media corporations and the public. Government also enters the picture at many levels. There are many types of leverage that government can exert to reduce environmental impact and motivate companies to redesign products and processes.

Herman Daly, the world renowned economist, formerly of World Bank, has



outlined how ecologically based tax reforms can stop rewarding intensive resource use, pollution and job destruction and reward companies that produce true 'goods' instead of ecological 'bads'.

Even among the investment people, narrow traditional notions of fiduciary responsibility are expanding to include ecological responsibility and a longer term analysis of financial returns.

Technology which may take to be hostile to the environment also has a new role to play in moving toward

sustainability. New zero emission industrial clusters are in the offing. There everything we now consider 'waste' becomes the raw material for an adjacent industry greatly minimising industry impacts on the earth.

A paradigm shift is needed to remedy the crisis of perceptions that today make it difficult to see our way toward a sustainable future.

**Source : *Steering Business Toward Sustainability*, Edited by Fritjof Capra and Gunter Pauli, The United Nations University, Tokyo, 1995.**

Confusion as to our true predicament has been created by means of extensive verbal pollution. Words such as sustainability, equity and justice have been contaminated by redefinitions that belong to the rich and powerful...

The search for a dynamic equilibrium, which is what true sustainability involves, is said to



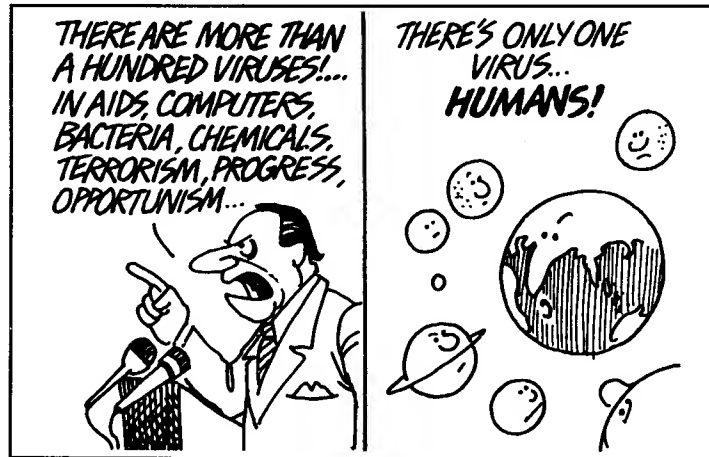
Old lamps  
for new

be "nostalgic" or "romantic", as though the survival of humanity were an archaic or eccentric preoccupation. The real victims of nostalgia and romanticism are those fundamentalists who want to rehabilitate the "eternal laws" of laissez faire economics.

**Winin Pereira and  
Jeremy Seabrook.**

## MAN'S WAR AGAINST NATURE

**T**oday man has waged a war against his own Mother, Mother Nature. In his limited wisdom, he interferes with the ways of nature. He thinks he is above nature's laws. Said a Nobel Laureate, "the purpose of science is to discover the laws that govern Nature and impose man's will on them". Man's imperfect understanding of the nature's laws has landed him with permanent cures for temporary problems, so that the cure becomes a problem when its day comes.



How much human interference will nature brook? There are economists who say that needs of ecological conservation should be balanced against the urgent economic needs. Who will feed a tiger when human beings are starving?

There are ecologists who argue that the problem is no more economics versus ecology. It is ecology, and good ecology is also good economics. Any talk of balancing economy against ecology is to balance the robber against the robbed and divide the loot.

But what nature has taken years to create the Coal Board is wiping out in 500 years. Petroleum produced by diligent nature over the years is getting wiped out in 200 years of irresponsible consumption. Biodiversity produced by nature in 4 billion years of its existence is being reduced to dead uniformity by 500 years of industrial technology.

Ethical, moral, social, familial values built assiduously by nature over thousands of years are being destroyed, atomised, individualised in mere 500 years of scientific and technological experimentation.

Religious values, spiritual traditions, practices of health and social

norms are being destroyed with accelerating speed. Habits and usages being tested in the crucible of mistaken logic and being found wanting, are being discarded.

Man has achieved only one thing. He has destroyed old bonds without creating new ones.



## THE SPIRITUAL PATH TO DEVELOPMENT

KAMLA CHOWDHRY

**O**n the first day of Independence, Jawaharlal Nehru, while addressing the nation said, "...it means the ending of poverty and ignorance and disease and inequality of opportunity". He further emphasised that "it must be clearly understood that the interests of our long suffering masses must come first and every entrenched interest that comes in their way must yield to them". With Independence we had looked forward to a future with confidence and hope and had believed that we would be free from hunger and poverty, and that everyone would enjoy the right of equal opportunity, that rich and poor, men and women would live in peace and dignity.

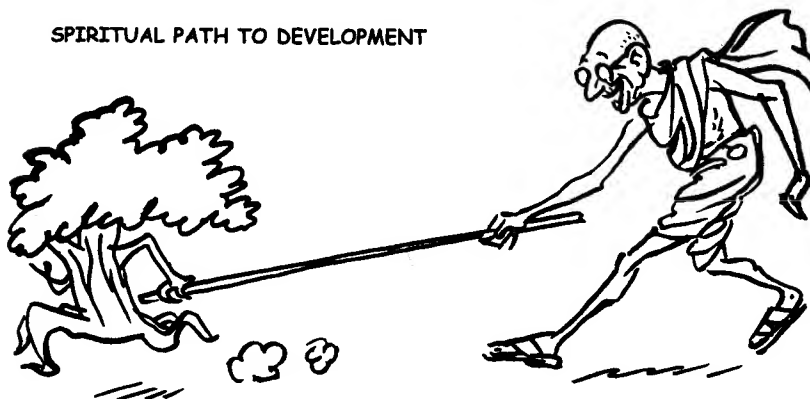
However our hopes and dreams lie shattered. A recent report on South Asia states that: "India has 35 million people who have no access to basic health facilities, 226 million lack access to safe drinking water, half of the adult population is illiterate, 70 per cent lacks basic sanitation facilities, and 40 per cent of the population survives in absolute poverty."

### WHERE DID WE GO WRONG?

We have begun to realise that borrowed ideas with roots in a different reality do not work, that we need to learn about the Indian reality and take into account the social, cultural and spiritual background of the people and the communities concerned.

As early as 1909 when Gandhiji wrote *Hind Swaraj*, he had warned that India must not copy the Western

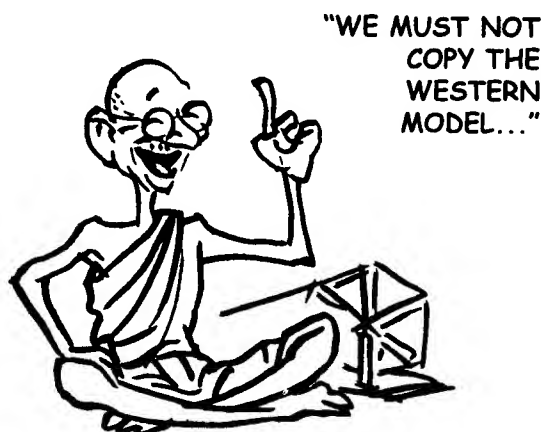
SPIRITUAL PATH TO DEVELOPMENT





model. He had often told Nehru that development must start with the rural people. Describing the Indian villager, Gandhiji has said, “an age old culture is hidden under an encrustment of crudeness. Behind the crude exterior you will find a deep reservoir of spirituality. You will not find such a thing in the West. Take away his chronic poverty and illiteracy and you have the finest specimen of what a cultured, cultivated, free citizen should be”. It is time to pause, to reflect what we have done to the finest specimen of a cultured, cultivated, free citizen of India.

Gandhiji was a deeply spiritual man. He derived his insights from the Gita and the Mahabharatha, as also from Tolstoy, Thoreau, and others. With all its variations and differences, the people are deeply connected with these epic stories. People from different backgrounds and traditions use metaphors from these epics to interpret their duty, their



obligation, their doubts and concerns, the nature of their relationships. These epics have a language of their own, and they provide a connectedness that nothing else can. Although Gandhiji was influenced by Western thought, he never let go of his roots. He helped restore the spiritual unity of the people, to discover the living elements in the old traditions, and to build upon them. He was able to awaken the masses from their slumber and static condition and make them dynamic. The masses were able to put their confidence in Gandhiji because he shared deeply with them their traditions, their culture and spirituality - and above all he shared their poverty.

The understanding of the masses, their cultural and spiritual concerns is essential if poverty is to be removed. Nehru called the dams and other large projects that were built as the new temples. But the new projects did not give the prosperity that was promised.

No change can be meaningful or ethically right if it is not prompted, conceived or desired by the people in question. Outsiders from a different background and culture are not in a position to perceive the people's problems, especially of the poor in all their complexity.

Vivekananda, like Gandhiji, was strongly opposed to the mindless copying of the West. As he said, “On one side, new India is saying, ‘if we only adopt Western ideas,

"OTHER'S IDEAS  
NEVER BECOME  
ONE'S OWN,  
NOTHING  
UNLESS EARNED  
IS YOUR OWN..."



Western language, Western food, Western dress and Western manners, we shall be as strong and powerful as the Western nations; on the other hand, traditional India is saying 'Fools, by imitation, other's ideas never become one's own, nothing unless earned, is your own, 'Does the ass in the lion's skin become the lion?'" Further, he added "the spell of imitating the West has such a hold that what is good or what is bad is no longer decided by reason, judgment, discrimination or reference to the shastras, whatever ideas, whatever manners the white man praises or likes, are good: the things they dislike or censure are bad. Is there a more tangible proof of foolishness than this?"

Two words in the Gita have greatly influenced culture and heritage - *aparigraha* meaning non-possession, and *samabhava* meaning equability, that is, remaining unruffled by victory or defeat, to work without concern for success or failure, in short, not to hanker after the fruits of action. These two words and what they reflect have deeply influenced our traditions, our

cultural values and lifestyles. Gandhiji took to the loin cloth and became the 'half-naked fakir' because he believed that as a representative of the masses he had no moral right to wear more than what the average man could afford. Khadi too spoke the same language of *aparigraha*, and, therefore, connectedness with the poor.

In the last 50 years, in the pursuit of 'development' we have created two Indias - the elitist, Westernised, largely urban India, and rural India, largely poor but still connected with the traditions and values of the past. The Westernised urban elites largely use the English language. Whereas, the rural poor use the local bhasha rich in references and symbols and associations with tradition, culture and spirituality.

Our development pundits, most of whom have been educated and exposed to the West are under the illusion that they have a complete understanding of the problems of the poor. There is, however, a growing realisation that if we wish to enter the 21st Century with the hopes and dreams as often expressed by Gandhiji and as stated by Nehru on our first Independence day, we need a new vision of development, which includes the social, cultural, spiritual values of our society, and which builds on the local culture and strength of the people. Our development pundits have perpetuated the agenda of the West, whereas the poor

try to alter and resist it according to their compulsions.

Let me mention some examples, where institutions having a religious, spiritual base and a connectedness with the past have contributed significantly to elimination of poverty, although their primary objective was to help in the spirituality of the individual and of the community.

#### Old lamps for new



We will be following the path to social justice if we base our actions on the old prayer in the Book of Proverbs: "Give me neither riches

nor poverty, but enough for my sustenance".

Richard Lannoy, in *THE SPEAKING TREE*, explores the whole range of Indian civilization and culture. He shows that our traditions make it difficult for us to adapt to the Western industrial system. At the end of it he reaches the fundamental and inevitable conclusion that it is not Indians who need to be squeezed into the Western mould, but rather that the Western system itself is incompatible with life on this planet.

***Winin Pereira and Jeremy Seabrook***

The Swadhyaya movement in Gujarat and Maharashtra (it also has an international membership) is based on the teachings of the Gita. The movement has transformed the lives of millions of people. It has taken a different route to development, a route where human and spiritual concerns are the starting point of economic change. Pandurang Shastri Athavale, founder of Swadhyaya, and winner of last year's Templeton Award for progress in Religion has taken the message of the Bhagavad Gita to thousands of villages and transformed millions of lives. The Templeton Foundation's announcement of the prize credits the Swadhyaya community with reaching out to nearly 100,000 villages and improving the lives of an estimated 20 million people.

In a drought prone area in Gujarat, the Swadhyaya engineers and technicians helped Swadhyaya villagers and communities to use rain water to recharge 94.465 wells and 208 dry lakes. The intermeshing of bhakti, devotion to God, with technical knowledge has provided new and creative ways of teachings and learning and transforming village institutions and village communities. (Similarly, Sai Baba has been able to arrange and organise availability of water in every single village of Anantapur district - a promise made by the Government 40-50 years ago and finally redeemed by Sai Baba).

In his acceptance speech at the Magasaysay Award ceremony, Pandurang Shastri described his work: "We Swadhyayees try to bridge the gap between the haves and the have-nots, but we are not socialists. We are engaged in removing the dirt and rust which have settled on our culture. Yet we are not reformers. We do try to emancipate women from their oppressed conditions but we are not women liberators. We are basically devotees. i.e. bhaktas.

Pandurang Shastri is a teacher of the Gita. In 1951 when he first started the movement with 19 people who came regularly to listen to his discourses, he told them: "Devotion should not be limited to temple worship, rites and rituals, singing and

chanting. This crude faith will drown us in oceans of ignorance; and man shall be degraded to a beastly sensual existence. Under such conditions, if young people like you who have studied the Upanishads and the Gita sit and do nothing, you will be guilty of neglecting your duty. Neither society, nor history, nor God will ever forgive the lapse on your part. You must go to the villages. This too is a form of devotion".

Thus the Swadhyaya movement and 'bhaktipheri' that is devotional tours to villages became an instrument of social activism. Every Swadhyayee practises bhakti by visiting five households every month. This 'bhakti' is an important instrument of social activism and change.

*Five Key issues were raised by the faiths in response to the World Development Report 2000:*

1. *The focus of development must be on people rather than economics, and particularly on poor people.*
2. *Poverty is not the same everywhere, and cannot be tackled by a single uniform set of policies.*



3. *Culture is the key to good development. A people's culture is the bed-rock of their identity. Changes should happen within cultures, not over them.*
4. *Work is essential for achieving dignity and respect. Besides providing a living, it should offer the opportunity for self-expression and service to the community.*
5. *Human beings have the responsibility to care for the environment. This means humanity must accept restraints and limits to growth.*

Majid Rahman from Iran, an international civil servant, in describing his encounter with the Swadhyaya movement said, "Swadhyaya has shown how a number of so called underdeveloped people were successfully 'developing' and adapting themselves to outside changes in ways much more effective and intelligent than what most professional experts in the field were able to offer".

Pandurang Shastri explains his method: "My effort is to create a new man who pursues the divine mission in which God is the Centre. Individual transformation and empowerment achieved through service to the divine. It treats economic development as a by-product of individual transformation and empowerment through service. Swadhyaya tackles the materialist Western worldview by reasserting the essential spiritual quality of human nature."

Gandhiji too had emphasised that the purpose of life is to know oneself. We cannot do it, he said, "unless we identify ourselves with all that lives. The sum total of the life is God. Hence the necessity of realising God living within everyone of us. The instrument of this knowledge is boundless selfless service."

As I began to look at the interface of spirituality and development I found many

good examples - the Ramakrishna Mission, the Vivekanand Kendras, the Sarvodaya movement and many others. They all talk of the same concerns as Pandurang Shastri. The 'bhakti' workers of these agencies and movements work closely with the poor, and are in touch with their vital problems. With these institutions and workers there is a continuity of tradition, a continuity of *aparigraha* and *samabhava*. They do borrow from the West but they keep their roots firmly in the Indian soil, culture and spirituality.

Slowly, but surely, development agencies too are recognising that development is a process that encompasses both the spiritual and the material aspects of life; that personal transformation goes hand in hand with social change. And there is a growing awareness that the borrowed Western model of development and social change has not worked because cultural and spiritual values of communities have not been woven in the fabric of development. Therefore the new development paradigm and strategies for elimination of poverty must be holistic and consistent with the deeper spiritual traditions of the people. If we have such a development paradigm we will be able to remove poverty - without it we will flounder and fail as we have done in the last 50 years.

*Courtesy: The Hindu, Aug. 1, '99.*

## THE TRANSITION TO SUSTAINABILITY

**T**he future of Indian agriculture looks bleak. There are just too many unsustainable factors which may reach crisis points, possibly simultaneously, possibly soon. The ultimate damage would depend on whether precautionary measures are taken immediately to move to a more sustainable position or whether "business as usual" leads to an even worse situation before collapse.

The occurrence of external factors which will force us to reduce our use of fossil fuels, for instance, could be either gradual or sudden. Oil and natural gas reserves are already getting exhausted, though they may

take decades to be completely depleted. First, their use as fuel would be restricted, then their use as raw materials for petrochemicals. The removal of subsidies on energy, fertilizers and pesticides, again already in progress, could be completed in a few years, causing a rise in prices which would force many farmers to give up the use of tractors and synthetic chemicals, but political upsets in oil - producing countries, triggered by internal or external forces, could be sudden.

Global warming is now an established fact. Atmospheric and ocean temperatures and ocean levels have already risen. The expected further rise may be gradual, with a rise of about 1 degree C in a few decades - unless positive feedback processes take over, in which case it could be sudden. Erratic weather conditions could occur much faster and could well be occurring now.

Most of the ancient "civilizations" have collapsed suddenly. The Western system, though extremely complex and claiming to be technologically sophisticated, is highly dependent on the availability of a few non-renewable raw materials. Pulling out just this



one thread from the intricate Western web, would unravel it totally.

Prudence and precautionary principle, therefore, require that action be begun immediately on sustainable substitutes, rather than wait for catastrophes to occur.

One of the Western cultural factors that militates against sustainability is the reductionist attitude that permeates official thinking. One department recommends the export of more meat while another bemoans the fact that pastures are being overgrazed. One department wants more exports of food,

while the other points out that people are starving. With imposed liberalization, each government department, each industry, each business person, in fact, works independently of the other, with no policy constraints determined by sustainability or justice at all. Each promotes its own interests without in the least bothering about what it does to other specialities or to agriculture as a whole. There is no overall comprehensive policy that gives priority to necessities over luxuries, or to sustainability over immediate profits.

The globalization of agriculture can only make the imbalance worse, as food is exported and prices of what's left rise, and as food is imported from countries where agriculture is highly subsidized and so on.

On the other hand, while there are lobbies to promote synthetic fertilizers and pesticides and many other unsustainable practices, there are no official ones to promote sustainable farming, with only a few scattered agricultural scientists and several NGOs working on this.

Sustainable solutions cannot, therefore, be expected from governmental, economic or even Westernized agricultural institutions.

Without changing the structures of power, little improvement can take place. But how can these be changed when they have become globally powerful and all-pervading?

#### Old lamps for new



Our traditional wisdom stressed a holistic system, where the independence of all animate and inanimate objects made them one whole and entire being. Union was considered superior to division, the undifferentiated to the differentiated. *Vidya*, true knowledge, gave the ability to see the whole, as one integrated, inclusive universe. *Avidya*, ignorance, denied that ability. *Avidya* has now become the cornerstone of the global "knowledge" system.

**Winin Pereira and Jeremy Seabrook**

The problem is that attempts to fight the structures using the means that those structures have themselves built up leads to frustration. Protestations against the wrong policies do not help since the dominating are naturally determined to retain their power. One cannot use the democratic system for bringing about change, since the democratic system is so corrupt that one can be elected only by becoming corrupt oneself, hardly a way of improving conditions. Working through the formal education system is similarly difficult, since it leaves no space for significant dialogue or alternative studies.

Many concerned people give up struggling against the system at this point since they believe that as powerless individuals they cannot win. However, while one cannot change the structures by using the institutions set up by the structures themselves, one work in the small spaces still available.

Farmers can refuse to purchase harmful synthetic agrochemicals. If a sufficient number do so, the manufacturers of those products will soon have to close down, or at least stop distributing them in that area. Consumers can stop using products made by unsustainable means, resulting in similar effects. There are numerous such opportunities available to individuals. While the individual may have no power to change the structures from within, everyone has the power to buy or not to buy. This is the only power that the unjust

structures have left to individual citizens. No police force or army can force a person to consume what she or he does not wish to consume.



In this way a transition from an unsustainable to a sustainable system can be introduced slowly, with little harm and dislocation. It is not of much use to make a long list of steps to be taken for such a journey since each individual starts from a different state and can work out the path she can most easily take. One helpful step that would save a lot of re-inventing would be to study traditional systems.

What has been presented in this book is only a micro-fraction of the knowledge that is available in old manuscripts and books and in the memories of those farmers who still practise sustainable agriculture. Rather than merely collecting such knowledge and recording it, it is far more important to preserve the culture that supports them, in



their practice and in their continuing innovation as they keep up with changing environmental and social conditions.

Ultimately, farmers and the rest of society, will have to develop a set of just values that will also solve the social problems that exist today. This requires the countering of Western culture, and the promotion of traditional cultures which values each creature for itself.

India's philosophy sees time as cyclic, not linear, with cycles within cycles. One cycle, the Chatur Yuga, is said to consist of four sub-cycles. It begins with the Krita Yuga, followed by the Treta Yuga; the Dvapara Yuga and the Kali Yuga. In the Krita Yuga, human beings are in harmony with all other creatures, even able to communicate with each other. But the situation gets progressively worse in the succeeding Yugas. We are now in the Kali Yuga. This decline is represented by a bull standing on four legs in the Krita Yuga, on three in the Treta, on two in the Dvapara and on one only in the Kali Yuga.

This may seem absurd to the Westernized since they see themselves as progressing rapidly through the use of their science and technology. But the allegory strikingly illustrates the corresponding degradation of environmental, economic and political conditions, the descent of man. Today,



the situation is so unstable that the slightest push could make it collapse. Such a nudge could come from the increasing intensity of already existing stresses, or from an unseen agent or catalyst waiting in the wings.

One redeeming feature of the Kali Yuga is that the situation is so bad that corrective actions are easy to take and everyone is capable of making them.

A move towards traditional, sustainable agriculture and industry would be such a major reform.

The question is, can we set the bull back gently on its four feet by timely action or will we be so slothful as to let it collapse completely?

The choice is ours.

**Source : *Tending the Earth*, Winin Pereira, Earthcare Books, Bombay, 1993.**

## SECURITY - THE NEW NAME OF DEVELOPMENT

WOLFGANG SACHS

***Prof. Wolfgang Sachs, internationally recognised proponent of the sustainable development of the weak of the world and author of the famous book "development dictionary" gave this address at the international seminar on sustainable development at Sewagram in January last (1992).***

Even those who think that Heraclitus is the name of a rock formation know the two phrases that the philosopher of Ephesus bequeathed to the West's partrimony of quotations. "All things flow: nothing abides" was the formula he used to describe the

continuous coming and going of existence. However as history does not always flow slowly and quietly, but sometimes surges forward impetuously, Heraclitus coined the other phrase: "War is the mother of all things". Heraclitus was referring to the clash between opposites in general, but there is considerable truth in the meaning that people generally give it: wars very often accelerate history, precipitate events and create new perspectives. My opinion is that the Gulf War marks the final curtain on the era in which the relationships between the North and South of the world could be considered in terms of "development". In its place, a new era is



dawning in which relationships with the Third World are dominated by the concept of "security".

## THE UNDER DEVELOPED

Let's go back a bit. Fortytwo years ago, on 20 January 1949, President Truman defined half the world with that ill-fated adjective "underdeveloped" which still characterizes our concept of the South. Far from being accidental, the new term clearly expresses a particular view of the world: for Truman, all the people in the world were moving along the same road; some more quickly, others more slowly, but all in a common direction. In the lead, he saw the nations of the North, especially the United States, while the rest of the nations, whose per capita income was infinitely lower than the American, remained behind. No matter what ideals the Peruvians, the Filippinos or the Indians thought of achieving, Truman saw them as latecomers, who had the historic task of closing the gap along the road to development and of pressing forward until they reached the group of riders in the lead. (The term was to catch up?) And the latter would show themselves to be generous and assist those who are lagging behind: the operation that was later called "development aid".

This is what, during the last forty years, has been meant by "development".

As time went on, the idea of a rapid recovery of the poor nations in the race towards economic well-being began to disintegrate, but it continued to dominate the development politics and economics, and foreign policy. Often, even the alternative concepts-such as a call for basic needs or social indicators-did not succeed in liberating themselves from this idea of universal development, or they were already carrying out something different from development politics, for example, security politics.

## SECURITY POLITICS

The war made still clearer one essential fact : the terrifying technological divide that today, more than ever, separates the richer countries from all the others. This is a divide that expresses itself in macabre statistics: 115 American soldiers lost their lives as opposed to 100,000 Iraqis, i.e. 1 to 1,000 a ratio which must be unique in the history of war. In spite of the inhuman efforts which Iraq made to arm itself to the teeth, its army was wiped out because technologically, it had remained, at the level of the 1970s. The defeat of Saddam Hussein, however desirable it might have been, became the symbol of the speed of innovation in the First World and of the powerlessness of the Third.

It is no longer possible to deny that

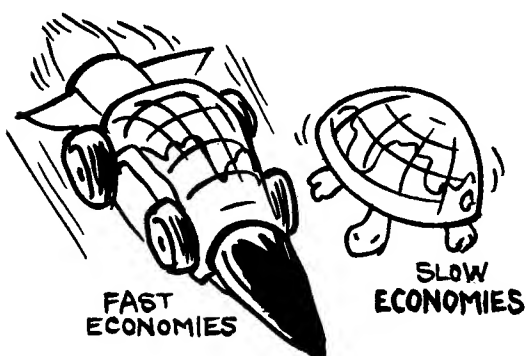
the idea of all the countries in the world are marching along a common road was but a post-war mirage. In actual fact, the world is divided between the international super economy of the upper class and the poor economy of an inferior class of country. It is no longer possible to say that everyone is moving in an interdependent economic space. On the contrary, the international super-economy and the poor economy of the South are separated by an authentic wall.

Much time has passed since, as in the Brandt Report, the North could have been considered the engine of the growth of the South. Still further back was the time when the North was dependent on raw materials, agricultural commodities and cheap labour—all things that a highly technologized economy can substitute with increasing facility. The North no longer needs the South: it can prosper on the exclusion of the rest of the world. The world is no longer divided between capitalism and communism, but between fast economies and slow economies - to quote Alvin

Toffler. After the spectacle of the recent war in the Gulf, it has become obvious that the nations of the world are not together along a universal road as the image of "development" implies, but are rigidly separated in a situation of planetary apartheid.

Not as a country where the hope is but where the risk is the way of perceiving the peoples of the South is thus changing. For Truman, the Third World societies were indeed poor, but full of potential. They were "young" nations and "emerging" whose future was to shine more splendidly than it did then. Such optimism is implicit in the very idea of development: in fact, where should the road of progress lead, if not to the promised land? In a situation of world apartheid, this concept collapses. No-one speaks any more of a radiant tomorrow, the future appears grim and the South is seen as the breeding ground of all crises. In a world divided, the countries of the South are no longer looked at with hope, but with suspicion. The South is no longer a place of progress, but of menace. In the cynical eye of the privileged, development aid is done for. Now the question is, at best, how to keep under a latent explosive force under control.

The Gulf war made it clear, once and for all, that the colonial territories, which later became the developing countries are



now risk zones. All kinds of dangers are to be found there, as the newspapers and television keep telling us: violence keeps exploding, the mafia is in command, epidemics are spreading, deserts are advancing, ideologies are rampant, and everywhere the demographic bomb is looming. And even the stronghold of the North is not immune from the threat of immigration, the green house effect of degradation. The more the threatening dangers strike fear into people's minds, the more the image of "The Other" takes on a different colouring. During the centuries it has been identified with the pagan, then with the savage, then the indigenous and finally with the poor, which today embodies the "risk factor".

In these circumstances, the "development" concept loses its reassuring connotations for the future: slowly it is being overlapped and finally substituted by the concept of "security" from the view point of the North. In fact, there are already development projects which have little to do with taking a country along the road to progress: in many cases, the "microprojects" content themselves with trying to prevent the worst (hunger, lack of health facilities, exploitation of nature) on a once-only basis. The times are gone when the order of the day was to "catch up" with the North. Now the aim must be to avoid being engulfed by the disaster and to engage in "security" for survival, according

to the new concept of development policy.

***From the Distribution of Riches to the Distribution of risk :*** At the international level, too, the change of theme has been under way for some time. Whereas, in the past, the discussion at multilateral conferences was whether and how to give the South more opportunities to enter into the world's economic growth. Today ways are being analysed as to how to keep the excesses of such growth under control. Governments are concerned about the signs of weakness in the biosphere - pollution of the seas, the ozone hole, global warming and attempt to reach agreements on emission levels and rights to pollute. Who should eliminate emissions, and how much, and in what period of time? Who is to take on what responsibilities? Who can claim what compensation? The focus of the international negotiations has changed: no longer is the division of wealth on the agenda but the division of risks.

***From aid for development to aid for prevention:*** In all this, the way that the North perceives itself has had to change too. Truman was proud of not considering the hegemony of the U.S.A. from a colonial view point, as the trustee of peoples who are still under age, but rather in terms of the economic prosperity of the whole world. In line with this conception, institutions for "aid" and "cooperation" were set up, which



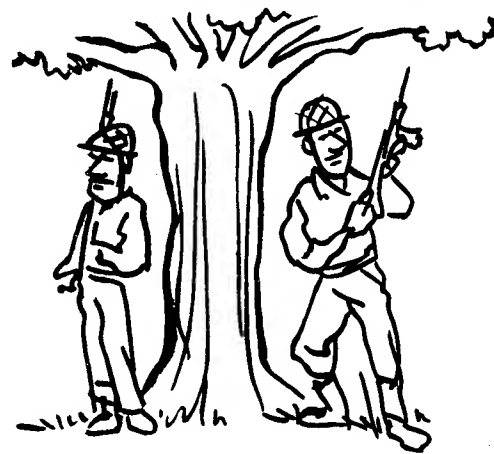
### IT'S TIME WE CHANGED OUR CAMOUFLAGE DRESS...

committed themselves to accelerating the thrust of the economy, activated as they were by the mirage of rapid achievement. Little has remained of all this under planetary apartheid: today, for reasons of self-defence, the North must prevent the collapse of the South from pulling down with it the societies of the North as well. From now on, the North will claim that it is obliged to exercise hegemony for the stability of the world system. No more aid for progress, but prevention of the threatening crises: this is the new justification for "development policy". After having served for a long time as the projection of our utopias, it now has the task of calming our fears.

From hegemony for the sake of progress to that of stability the *Time* magazine of 1 April dedicated its cover page

to fears about security with the image of a uniformed body bearing neatly a sheriff's badge, on which was written "Global Cop". The new attitude also has its military expression in the present planning of a multinational intervention force. Whether this belongs to WEU, NATO or the UN is of secondary importance. What is under way is an epoch-making reorganization of the military apparatus towards wars of low and medium intensity in the South of the world (and in the East, which is slowly slipping towards the South).

In a more charity-oriented variation, troops are being sent to populations who are struck by natural disasters such as recently happened in Bangladesh and Kurdistan, while one is beginning to hear talk of "green helmets" to intervene in the case of ecological disasters. And people are talking about the planetary environmental crisis in terms of "ecological security".



ECOLOGICAL SECURITY

Ecology, once the rallying cry for new public virtues, has become a problem of security policy. Satellites are launched that keep an eye on far-away countries—veritable environmental spies.

The real novelty of the Gulf war was the alignment of the international community against the dictator of Baghdad. The club of countries that for years have been

meeting at the economic summit are now increasing their diplomatic, charity and military instruments for risk prevention. But, where there is no justice, there cannot be peace. The new way of seeing things in terms of security is the tragic consequence of the continuing arrogance of power.

*From : Science for Villages,  
June-Sept. 1993.*



## CONSCIOUS EFFORTS FOR SUSTAINABILITY

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ALAN HERBERT

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**W**illiam D. Ruckelhaus, the U.S. representative on the Brundtland Commission, puts it in a nutshell. "Can we move nations and people in the direction of sustainability? Such a move would be a modification of society comparable in scale to... that of the Agricultural Revolution and the Industrial Revolution. Those revolutions were gradual, spontaneous, and largely unconscious. This one will have to be a fully conscious operation, guided by the best foresight that science can provide. If we actually do it, the undertaking will be absolutely unique in humanity's stay on the Earth."

The changes necessary to create a sustainable future for the planet will have to be rapid and will have to take place on many fronts, and in many different dimensions - political, social, economic, psychological - simultaneously.

Some of the most important changes will involve:

- ♦ substituting renewable energy for energy produced from non-renewable fossil fuels.
- ♦ improving industrial technologies so that more efficient use is made of scarce resources and less pollution is produced.
- ♦ rigorously controlling and phasing out of activities that damage the biosphere.
- ♦ a large-scale, two-way transfer of sustainable knowledge and technology between the developed and the developing nations.
- ♦ massive reafforestation projects and the adoption of natural, organic farming practices on a wide scale.
- ♦ vigorous protection of the planet's biodiversity.
- ♦ an immense effort, involving major structural changes in the developed world's economy and development
- ♦ stabilising the world's population.



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- |   |   |
|---|---|
| policies, to improve the life-style of those in the developing world, with a particular emphasis upon the education and social liberation of women. | ♦ adopting wide-scale conservation and recycling practices.             |
| ♦ a more equitable allocation of global resources and benefits.   | ♦ stopping the Arms Race.   |
|   | ♦ substituting values based upon conservation for those of consumerism. |



## **SUSTAINING MOUNTAIN PEOPLES AND ENVIRONMENTS**

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**DEREK DENNISTON**

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**M**ountains span one fifth of the landscape and are home to one-tenth of humanity. An additional 2 billion people live downstream from them, and depend on their ample water, hydropower, grassland, timber, and mineral resources. And 7 of the world's 14 tropical "hotspots" of endemic plants threatened by imminent destruction have at least half their area in tropical mountains. The enormous layers of complexity of mountain landscapes - their climates, vegetation, and wildlife have spawned great cultural diversity as well. For instance, several million tribal farmers and pastoralists reside in the mountains of Afghanistan, China, Iran, Nepal, Pakistan, and the Central Asian nations of the former Soviet Union.

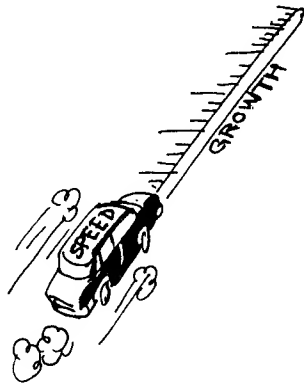
Mountain cultures and ecosystems face three primary threats from the expanding world economy: land scarcity fuelled by inequitable ownership patterns and control of public resources, intensive resource extraction, and mass tourism and recreation. Around the world, mountain peoples risk increasing cultural assimilation, debilitating poverty, and political disempowerment. After millennia of intensive human transformation of the surrounding lowlands and flatlands, mountains have become vertical islands of cultural and biological diversity surrounded by seas of biological impoverishment and cultural homogeneity. This enormous diversity makes mountains one of the last major opportunities for conserving natural and human variety.

*From : State of the World 1995.*

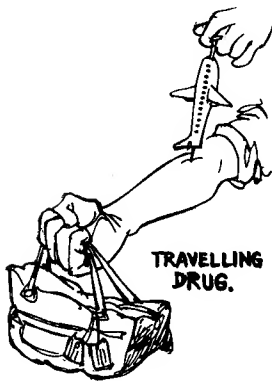
## SPEED AS THE MEASURE OF CIVILIZATION

In the new Industrial society and in the not-so-industrialised-societies that try to ape it, speed is the measure of progress,

SPEED AS THE MEASURE  
OF CIVILIZATION



growth, civilization, advancement, modernity, in short, goodness. The people in such societies live faster, they live where action is, live in a fast pace of life, quicker tempo, speeded up urban life, - these are the expressions that describe progress and set the standard for modernity.



People are always driving somewhere for no particular reason... Travelling is the

drug of the moment. It is an aimless drive. 'Rat race' is another term used.

Conflict between generations, between parents and children, between husbands and wives, can be traced to differential responses to the acceleration of the pace of life. The same is true of clashes between cultures.

The new technology on which super industrialism is based, much of it blueprinted in American research labs, brings with it an inevitable acceleration of change, in society, and a concomitant speed up of the pace of individual life as well. Europe resents America's alien time sense invading it. America as the spearhead of super industrialism represents a new, quicker and very much unwanted tempo.

Acceleration in the pace of life may prove disruptive and uncomfortable.

Time is compressed. Man is caught offguard by faster moving people and events around him. Durations of situations get frequently shortened.

The pace of life is a crucially important psychological variable. Everyday life is invested with a new temporariness called transience. It results in a mood, a feeling of impermanence. Man feels he is “permanently transient”. “We are all people in all the rooming houses, everywhere, none of us occupy abodes of safety true homes”.

Man’s relations with things, places, peoples, organizations and ideas become like those of shorter and shorter duration.

Transience therefore is the rate of turnover of the different kinds of relationships in an individual’s life.

In his life, things, places, peoples, ideas, organizational structures all get “used up” more quickly.

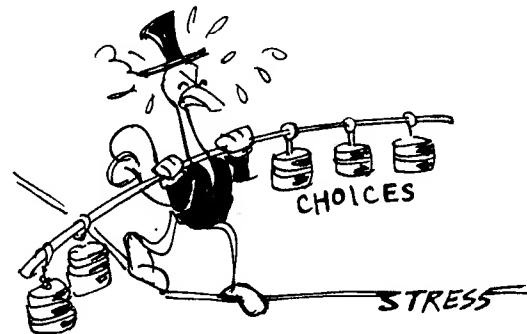
Man is exposed to Transience, Novelty and Diversity. Transience brings him face to face with a throw-away culture, an economy of impermanence. He has become a nomad. He travels a lot, much of it needlessly. The durations of human relationship are getting shorter and shorter. Organizations are becoming ad-hocism dominated.

### **FAMILY GETS FRACTURED**

Overchoice stares at man. A surfeit of subculture surrounds his life. A wide va-

riety of lifestyles present an endless list of choices in front of him.

All these have combined to present Man with what is called in the most commonly used term today, ‘STRESS’! Man’s suffering today is compared to aquatic creatures thrown on to the newly formed beach, by the waves of shrinking seas—dying,



gasping and clawing for each additional instant of eternity.

Temperature, pressure, calorie intake, oxygen and carbondioxide levels all set absolute boundaries beyond which man as he is now constituted cannot venture.

By endlessly accelerating change, without first determining man’s tolerance limits, we may submit masses of men to demands they simply cannot tolerate. We run the high risk of throwing them into a peculiar state that I call FUTURE SHOCK.

Future Shock is the distress both physical and psychological that arises from

an overload of the human organism's physical adaptive systems and its decision making processes. Put more simply, Future Shock is the human response to overstimulation.

The symptoms of this Shock are :  
i) anxiety ii) hostility to helpful authority  
iii) senseless violence iv) physical illness  
v) depression vi) apathy vii) erratic swings in  
interest and life style viii) effort to crawl into  
their shells ix) social, intellectual, emotional,  
withdrawl x) feeling continually bugged or  
harassed, and wanting to take fewer decisions.  
These are diseases of ADAPTATION.

Adaptive demands of the environment places heavy demands on the health of a person. Diseases result from

the general nature of the environment surrounding the body.

With spreading alarm of air pollution, water pollution, urban crowding etc. health authorities are realising that the individual is a part of a total system, his health depends upon many subtle external factors.

The general rate of change in a person's life could be one of the most important environmental factors of all.

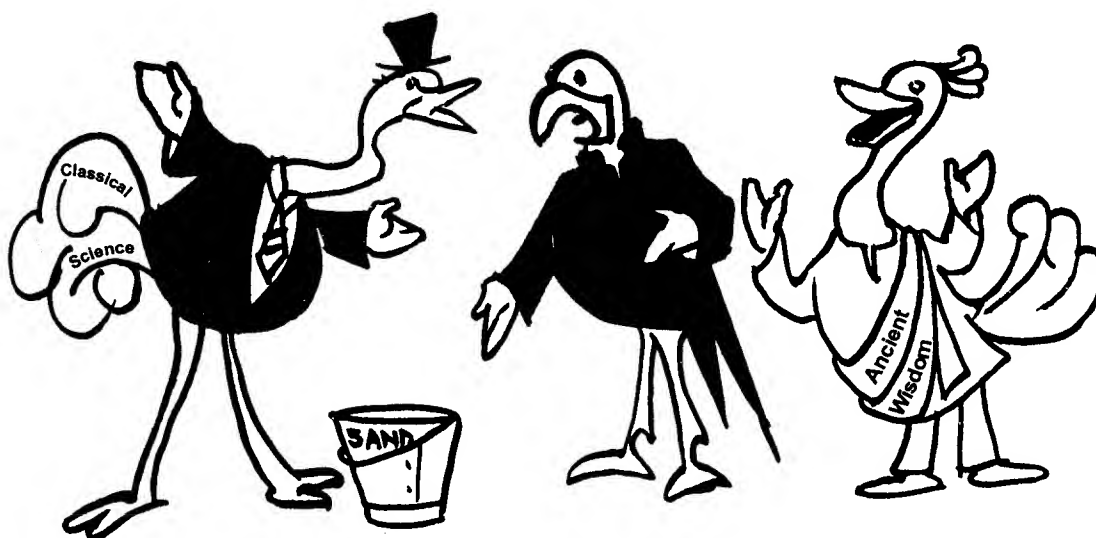
Those with high life change scores (incidences) were more likely than their fellows to be ill in the following year if the pace of a person's life is closely tied to the state of his health.

**Adapted from Future Shock -  
*Alvin Toffler.***



## **ANCIENT WISDOM OF THE EAST AND MODERN HOLISTIC SCIENCE JOIN HANDS TO FACE THE CLASSICAL SCIENCE OF THE WEST**

| <b>CLASSICAL SCIENCE /<br/>WESTERN WAY OF LIFE</b>                    | <b>MODERN HOLISTIC SCIENCE AND<br/>ANCIENT WISDOM /<br/>HOLISTIC WAY OF LIFE</b> |
|---|--|
| 1. Accidental collocation of atoms                                    | Living bonding   |
| 2. Urban-based, promoting<br>urbanisation values                      | Village-based-promoting rural  |
| 3. Utility- based   | Value + utility- based   |
| 4. Capital intensive  | Low capital  |
| 5. Market-oriented  | Man- oriented  |
| 6. Aggressive male biased   | Passive gender neutral   |
| 7. Machine-oriented (replaces man)                                    | Tool-oriented (extends man)  |
| 8. Family community breakdown   | Kept in tact   |
| 9. Centripetal  | Centrifugal, decentralised   |
| 10. High input  | Low input, local, Swadeshi   |
| 11. Production for market   | Production for consumption   |
| 12. Energy intensive  | Labour intensive   |
| 13. Fossil coal, Petrol, Nuclear,<br>Simple machine; Renewable energy | Fuel, bullock cart, manual labour<br>sources                                     |
| 14. River economy   | Bucket economy   |
| 15. Exploitation  | Sharing  |



|   |                                 |
|---|---------------------------------|
| 16. Polluting                                     | Clean                           |
| 17. Politically designed                          | Nature made, Swayambhu          |
| 18. Value free                                    | Value-oriented                  |
| 19. Colonising                                    | Freeing                         |
| 20. Technology based                              | Tradition-based                 |
| 21. Complex                                       | Simple                          |
| 22. Advertisement based sales                     | Need-based sales                |
| 23. Multiplication of wants                       | Reduction of wants              |
| 24. Gap between Rich/Poor increases               | Decreases                       |
| 25. Materialistic                                 | Spiritual, religious            |
| 26. Creates Tension, High BP, Heartache, allergy. | Health Oriented                 |
| 27. Use of drugs, medicines alcohol, addictions   | Natural, herbal medicines, yoga |

|   |  |
|---|--|
| 28. Largescale technology                             | Appropriate technology   |
| 29. Specialisation                                    | Generalisation   |
| 30. Monoculture                                       | Multicultural  |
| 31. Violent   | Nonviolent   |
| 32. Searches for happiness in the outside world       | Helps man to search for happiness inside himself                                 |
| 33. Analytical wisdom                                 | Integrating wisdom   |
| 34. Generates unemployment                            | Generates employment   |
| 35. Throw away technology                             | Reuse, recycle technology  |
| 36. Accepts GMF<br>Genetically modified food products | Does not accept goes for pranic<br>Energy rich natural food                      |
| 37. High transaction costs                            | Low transport, transaction costs   |
| 38. Does not recognise Prana                          | Does recognize Prana   |
| 39. Promotes food processing                          | Promotes raw food  |
| 40. Selective utilisation of raw<br>ating waste       | Generalised utilisation of Raw material / cre-<br>material full use, optimum use |
| 41. Monoculture on farm                               | Mixed farming  |
| 42. Farm/diary separated                              | Farm/diary integrated  |
| 43. Creates, cultural, ecological<br>ronment          | Integrates individual with society and envi-<br>refugees                         |
| 44. Planning central                                  | Planning decentralised   |
| 45. Court, law, centralised                           | Community courts   |
| 46. Big dams  | Local watersheds.  |



# THE LEARNING PROCESS WITHIN CORPORATIONS FOR SUSTAINABLE DEVELOPMENT

OSCAR MOTO MPURA

**B**usiness concerns are rapidly becoming the most powerful institution of the planet. They have a tremendous power to help create a considerably better or worse world. And most of that power does not come from their financial or technological resources. It stems from the people. People who have been trained to be productive as a group. People trained to make things happen.

Nonetheless, paradoxically, the business world still hesitates in fully using its strength to build a better world. A world with a higher quality of life for everyone on the planet.

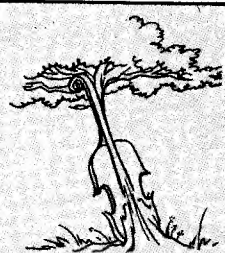
Business people are hesitant because they are still bound to a lower level of consciousness. A level where the prevailing

assumption is the "survival of the fittest" in a world of limited resources.

As we quickly approach a new world where resources are no longer the leverage factor for change, where values, ideas, knowledge, and human talent are the new key factors of "success," we also become conscious of the new possibilities open for the human being. The "impossible" is becoming possible.

The "possible impossible" seems to be the realm of the people who dare to act. The ones that courageously take the first steps towards their ideals, their dream.

A good story that illustrates that point is the case of Mrs. Jocelia Santos de Souza, a young wife of a construction



Music should continue

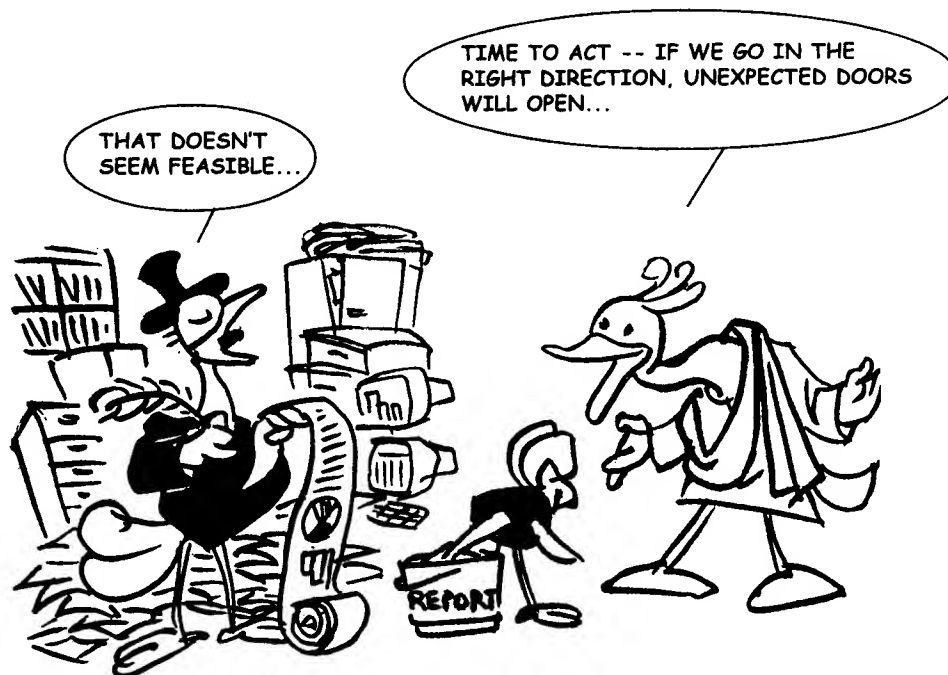
*Following passage from JM Keynes' essay on national self-sufficiency: "I sympathise, with those who would minimise, rather than those who would maximise, economic entanglement between nations. Ideas, knowledge, art, hospitality, travel - these are the things which should of their nature be international. But let goods be homespun whenever it is reasonably and conveniently possible, and, above all, let finance be primarily national".*

worker living in a very poor neighbourhood of Sao Paulo, Brazil. Noticing that many small children in the region did not have anything to eat because both parents were at work the whole day, she decided to offer lunch for three children who were playing with her own children. The following day she had six children coming for lunch. And they kept coming: 10, 20, 50. As the group got larger, help from neighbours naturally started to come. Today, she is providing almost one thousand meals every day and keeps creating new projects to help those children develop a decent future for themselves through better education and better work opportunities.

The fundamental question that is in the heart of that story is: What would have happened to her 'project' if she - before offering the first three meals - had decided to make a "feasibility study," as we are used to doing in the business world? Would she have started it?

Business people seem to be still hesitant, spending their time with unending feasibility studies on "ecology projects." This is a time for action. For first steps. Ideas are great but they must be quickly followed by courageous action.

This is a time for global action. As globalization is definitely something beyond



a mere theory, and as high technology actualizes, for the first time in history, the idea of humanity, we seem to have today all the necessary conditions to create a better world for all.

It is time to act. And as we go in the right direction, unexpected doors will be open, making the apparently “impossible” a reality.

That certainly is not a typical business assumption. It is an assumption that transcends the traditional business realm.

Educating for deep ecology and sustainability goes beyond the education of minds. Ultimately, it leads to the evolution of the spirit.

**It involves :** Systemic Executive Development Program.

The Executive as a Statesman (The Principle of Interdependence).

The Executive as a Strategist (The Principle of Flexibility).

The Executive as a Change Agent (The Principle of Ecological Cycles).

The Executive as an Architect of Processes and Networks (The Principle of Partnership).

The Executive as a Negotiator (The Principle of Diversity).

The Executive as an Educator (The Principle of Co-Evolution).

The Executive as a Living Example (The Principle of Energy Flow).

The Executive as a Cultivator of Values (The Principle of Sustainability).

***From : Steering Business Toward Sustainability, The United Nations University, Tokyo, 1995.***



## VALUING NATURE'S SERVICES

JANET N. ABRAMOVITZ (SOW 1997)

### I. INTRODUCTION

Nature's invisible services form the invisible foundation that supports our societies and economies. Oceans provide us fish, forests supply us with wood and new medicines. Insects pollinate our crops, birds and frogs keep pests in check, rivers supply clean water for us.

We expect Nature to supply us, in predictable cycles, our needs including air and water. The waste we generate will automatically disappear, we hope. Our

#### VALUING NATURAL SERVICES



climate will be stable and predictable, we assume. Nature's services have always been there for free for the taking, and our expectations and economies are based on the premise that they always will be.

We tend to misuse and destroy nature by under-appreciating and under-valuing its services. Economies provide the incentives for such wrong evaluation and abuse, Nature in turn is less able to supply the services, the earth's expanding population and economy demand.

Human prospects and our very existence are being threatened because of the continued loss of nature's services.

Nature is viewed as a boundless and inexhaustible resource and link. Human impact is seen as significant and beneficial. While measuring GDP, gross domestic product of each nation, Nature's contribution is not at all considered. We add pollution and deplete natural capital, counting these actions as contributions to economic well being.

In nature the distinction between goods and services as is done in the case of man, is not possible. In nature, goods and services are highly integrated in subtle and complex ways. Treating nature as a box full of unrelated objects that we can remove or replace at will with no effect, is counterproductive.

Nature's ecosystem (1) produces raw materials, (2) purifies and regulates water, (3) absorbs and decomposes wastes, (4) cycles nutrients, (5) creates and maintains soils, (6) provides pollination and pest control, (7) regulates local and global climate.

### **1.1. NATURE'S SERVICES**

- (1) Raw materials production, food, fisheries, timber, building materials, non-timber forest products. Fodder, genetic resources, medicine, dyes.
- (2) Pollination
- (3) Biological control of pests diseases
- (4) Habitat and refuge
- (5) Water supply and regulation
- (6) Waste recycling/pollution control
- (7) Nutrient recycling
- (8) Soil building and maintenance
- (9) Disturbance regulation
- (10) Climate regulation

- (11) Atmospheric regulation
- (12) Recreation
- (13) Cultural
- (14) Educational/Scientific.

### **1.2. AN INTEGRATED SYSTEM**

Forests for example supply timber, provide habitat for birds and insects that pollinate crops and control disease and agricultural pests. Their canopies break the force of the winds, and reduce rainfall's impact on the ground, which lessens soil erosion. Their roots hold soil in place, further reducing erosion. A forest's water shed protection alone can exceed the value of its timber. Forests also act as effective water pumping and recycling machinery, helping to stabilise local climate. Through photosynthesis plants generate life-giving oxygen and hold vast amount of carbon in storage which stabilizes the global climate.

### **1.3. CONVERSION OF ECO-SYSTEMS**

Conversion, degradation, fragmentation and simplification of ecosystems have taken place extensively in the world. In many countries, more than half the territory has been converted from natural habitat to other uses, much of it unsustainably and reversibly. The last decade of the 20th century saw further decay. Along with the

ecosystem the services which they provide are also lost.

### 1.4. BIO-DIVERSITY DEFICIT

Nature's living library of genes, species, populations, communities and ecosystems in existence today, represent a wealth of options for future generations and

WE'RE RUNNING A  
BIO-DIVERSITY DEFICIT --



--DESTROYING SPECIES AND ECOSYSTEMS  
A THOUSAND TIMES FASTER THAN  
NATURAL EXTINCTION RATES

for change in the biosphere. We are running a bio-diversity deficit, destroying species and ecosystems a thousand times faster than natural extinction rates as a result of human actions.

We are reducing nature's capacity to evolve and create new life. In a few centuries, we have gone from living off nature's interest to spending down the capital that has accumulated over millions of years of evolution, as well as diminishing the capacity of nature to build new capital. Humans are only one part of nature's evolutionary product. We are endangering nature's safety nets.

## II. DEVELOPING AND PRODUCING

### *Raw Materials*

Nature develops and produces commodities vital to our well-being. Nature synthesises and produces food, fibre, fuel, fertilizers, building materials, medicines, and objects of aesthetic value. These healthy ecosystems are getting degraded today. Enormous variety and value of goods produced and collected in wild areas and their importance to local livelihoods and National economies are global phenomena.

Rattan, a vine used in basket- making gives employment to half a million Asians, trading in 2.7 billion dollars worth materials. Fish catch in U.S. were worth 3.3 billion dollars a year, and the processing industry ten times that amount.

Land races and wild relatives of today's crops contribute 66 billion dollars to the global economy. One wild wheat from Turkey alone provides disease resistance worth 50 million dollars a year. Crop characteristics such as vigour, yield, salt tolerance and resistance to pests and diseases are the gifts from old or wild varieties. All of today's crops are derivatives of wild varieties.

80% of world's medicines in developing countries come from traditional sources. In U.S. 25% prescription and 60% of non-prescription medicines have active components extracted from natural products. Many major medicines originated from nature. Medicines from natural products are worth 40 billion dollars a year to the world. New medicines with natural resources as components are being evolved. Of nature's sources a scientist said "These are little chemical factories that are in essence doing what drug companies are trying to do. They have created thousands of chemical compounds and refined them to be exquisitely sensitive and potent. The lost pharmaceutical value from plant species extinction's in U.S. alone is estimated at 12 billion dollars."

Not maximising the production of an ecosystem (e.g. timber in a forest) to a single commodity but multipurpose use is more profitable. In Indonesia not cutting a forest would give people an income of 10 million dollars and protect fisheries worth 25 million dollars a year. An hectare of standing forest gives 4800 dollars of non timber income and 3600 dollars of timber income.

### **IN INDIA**

The minor forest products account for three-fourth of net export income of forests

and half the employment. The role of harvested wild goods in local economics and households is very valuable. They are part of flexible and sustainable livelihood systems that provide food and income security. Wild products collected for personal consumptions, as well as traded markets include vegetables, fruits, game meat, fish, medicines, dyes, and thatching materials. In Laos and Ghana hundreds of wild plants and animals are collected and used in a parallel economy. Earnings from collecting and processing wild products are substantial. They keep people employed and fed.

When such areas are converted or managed for a single commodity, other benefits and services are lost. For e.g. coastal mangroves as aquaculture fields.

Wetlands buffer coasts from storms and erosion, cycle nutrients, serve as nurseries, and supply critical resources.

### **III. APPRECIATING SERVICE PROVIDERS**

Nature nurtures innumerable species that are not harvested directly but that provide important "free" services. These creatures (1) pollinate crops, (2) keep potentially harmful organisms in check, (3) build and maintain soils and (4) decompose dead matter so that it can build new life.

Nature's service providers, birds, bees, insects, worms and micro-organisms show how small things can have disproportionate value. Unfortunately their services are increasingly in short supply because (1) chemicals, (2) disease, (3)



**NATURE'S SERVICE PROVIDERS BIRDS, BEES, INSECTS, WORMS & MICRO-ORGANISMS SHOW HOW SMALL THINGS CAN HAVE DISPROPORTIONATE VALUE**

hunting, (4) habitat fragmentation and (5) destruction have drastically reduced their numbers and ability to function. For e.g. pollinators, "nature's most productive workers are slowly being put out of business".

The service as pollinator is being carried out by 120,000 to 200,000 animal species. They include, bees, beetles, butterflies, moths, ants, flies, 1000 species of vertebrates, such as birds, bats, possums, lemurs, — all or most of them are disturbed, their work being hindered. Eighty percent of world's 1330 cultivated crop species are pollinated by wild and semi-wild pollinators. For e.g. honey bee

pollination services are 60-100 times more valuable than the honey they produce. The value of blueberry bees is so great, that each one pollinating 15-19 litres of blue berries in its life that they are called by farmers "flying 2000 rupee notes".

But many modern agricultural practices actually limit the productivity of crops by reducing pollination; pollinator resting sites are reduced. Their nectar supplies are poisoned. Their migratory routes are disrupted.

In nature's underground economy soils support the roots of plants. They also house insects, worms, and micro-organisms that decompose matter. A hectare of healthy soil contains thousands of kgs of earthworms, insects, spiders, fungi, bacteria, algae and protozoa. Change in land use affects their functions. Exposure, erosion, and chemicals kill the living beneficial organisms of the soil.

Buffer areas (uncultivated border areas with wild growths) reduce wind erosion and control pollution that escapes from agricultural fields. The sacred groves of South Asia do this job.

#### **IV. CYCLING AND RECYCLING**

Many of nature's services arise from its ability to regulate and recycle water,



nutrients and waste. But human interruptions have impaired this ability to filter and regulate water to recharge ground water supplies, and to move nutrients and sediments.

The water cycle as rain, river and sea-evaporation is disrupted by man. Slow movement of water on surface, essential for recharging ground water is speeded up. In Florida a 223,000 hectare swamp stores enough water and charges aquifer. Its services are worth 25 million dollar per year. The value of mangroves in flood control is worth 300,000 dollar per km. The natural filtering capacity of rivers upstream from New York is one-tenth of what the city would be paying otherwise to get the job done.

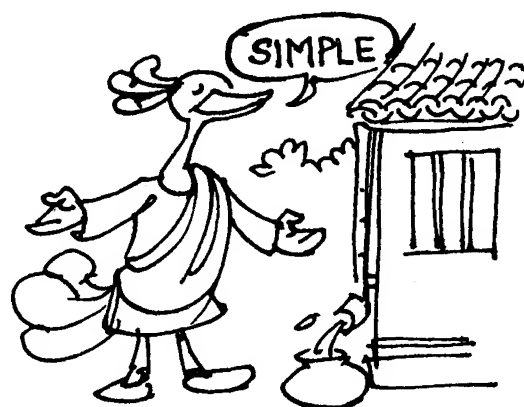
Watersheds absorb and cleanse water, recycle excess nutrients, hold soil in place, and prevent flooding. The soil if allowed to be eroded carries nutrients, sediments, and chemicals valuable to the system it leaves, but often harmful to the ultimate destination.

The worldwide costs of agri-soil erosion is 400 billion dollar per year.

## V. NATURE'S STABILITY AND RESILIENCE

A fundamental service provided by nature is ensuring that ecosystems and the entire biosphere are relatively stable and

resilient. The ability to withstand disturbances and bounce back from regular "shocks" is essential to keeping the life-support system operating. Maintaining the integrity of the web of species, functions, and processes within a system and the webs that connect different systems is critical for ensuring stability and resilience. As systems are simplified, and their webs become disconnected, they become more brittle, and vulnerable to catastrophic irreversible decline. From global climate change and break down of ozone layer to



the bio-diversity deficit, the collapse of fisheries, frequent outbreaks of high-tides, and increasingly severe floods and droughts, there is now ample evidence that the biosphere is becoming less resilient.

Promoting uniformity increases brittleness. Diversity is eliminated. Today fewer than 100 species provide most of the world's food supply. The vulnerability to disease and pest is at its worst today.

Loss of bio-diversity, loss of coastal wet lands, changes of land use, all will have a telling effect on man and his living environment.

## **VI. WHAT TO DO?**

- (1) Understand nature's services better.
- (2) Value her services better.
- (3) Understand the interconnected web of life that we are part of that which supports us.
- (4) Educate the public.
- (5) Realise the cumulative effect of human activities on nature.
- (6) Learn how we can conduct the human enterprise within nature's regenerative capacity.
- (7) Count nature's services – the life support systems.
- (8) Learn to evaluate the environmental degradation and lost ecosystem services.
- (9) Learn that the market is not the plea to evaluate nature.
- (10) Learn that Nature's services and supplies are not cost free. Nor are they in unlimited abundance.
- (11) Internalise the economic externalities.
- (12) BUT ACKNOWLEDGE THAT EVERYTHING DOES NOT HAVE A PRICE. MUCH OF NATURE'S VALUE IS QUITE LITERALLY BEYOND MEASURE. EVOLUTION AND RESILIENCE ARE PRICELESS. ASSESSING THE TOTAL VALUE, ECONOMIC AND OTHERWISE, OF AN ECOSYSTEM REQUIRES LOOKING AT MORE THAN THE AMOUNT OF MONEY THAT CAN BE MADE FROM A PIECE OF LAND.
- (13) See who benefits. See who loses.
- (14) Recognise that different people have different values for the same goods and services.
- (15) Leave something for the next generation and the next and the next by using nature's energy and water supply with utmost efficiency and reversing the conversion, simplification and degradation of ecosystems.

As the authors of a new Genuine Progress Indicator (GPI) put it, "The GDP makes no distinction between economic transactions that add to well-being and those which diminish it. ...As a result, the GDP marks the breakdown of social structure and natural habitat; and worse, it

portrays this breakdown as economic gain." While global GDP has been rising in recent decades, for example, the world's population living in poverty has been increasing, the distribution of income has become less equitable, the biodiversity deficit is growing, and the

loss of nature's services has worsened. The values of nature's unmarketed goods and ecosystem services as well as the unpaid labour in households and communities must be incorporated into economic calculations and performance indicators.

## POINTS TO PONDER



**Listen**

The human world is beyond its limits: the present way of doing things is unsustainable. The future, to be viable at all, must be one of drawing back, easing

down, healing. Poverty cannot be ended by indefinite growth; it will have to be addressed while the material economy contracts.

### *Beyond the Limits*

We need to stop thinking and acting like cowboys on an open plain and begin to act and think like astronauts who recognise that their lives depend on the supplies and life-supports system of their spacecraft.

### *Getting to the 21st Century*

Our collective future depends on achieving a transformation of our

institutions, technology, values and behaviour consistent with our ecological and social realities. It must address three basic needs 1) Justice 2) Sustainability 3) Inclusiveness.

### *Getting to the 21st Century*

The elimination of unjust structures depends on the emergence of an alternative human consciousness.

### *Getting to the 21st Century*

Man is like every other species in being able to reproduce beyond the carrying capacity of any finite habitat. Man is like no other species in that he is capable of thinking about this fact and discovering its consequences.

**William R. Cotton**

The world's leaders do not know any better than anyone else how to bring about a sustainable society. A sustainable society requires each person to act as a learning leader at some level.

### *Getting to the 21st Century*

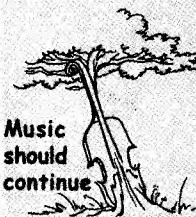


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One thing seems obvious, humanity has reached a certain state of general tension – tension in effort, in action, even in daily life – with such an excessive overactivity, so widespread a trepidation, that the whole mass of mankind seems to have come to a point where either it must break through the resistance and emerge into a new consciousness or else fall back into an abyss of darkness and inertia.

**By Mother**

An age of expansion is giving way to an age of equilibrium. The achievement of this equilibrium is the task of the next few centuries... The theme for the new period will be neither arms and the man nor machines and the man: its theme will be the resurgence of life, the displacement of the mechanical by the organic, and the re-establishment of the person as the ultimate term of all human effort. Cultivation, humanisation,

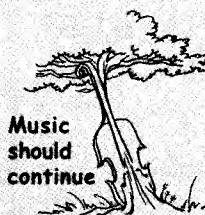


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cooperation, symbiosis; these are the watchwords of the new world-enveloping culture.

**Lewis Mumford**

The humanism consonant with our epoch must replace and reverse principles and norms that we have heretofore regarded as untouchable... it must encourage the rise of new value systems to redress our inner balance,



Music should  
continue

and of new spiritual, ethical, philosophical, social, aesthetic and artistic motivations to fill the emptiness of our life; it must be capable of restoring within us... love, friendship, understanding, solidarity, a spirit of sacrifice, conviviality; it must make us understand that the more closely these qualities link us to other forms of life and to our brothers and sisters everywhere in the world, the more we shall gain.

**Aurelio Peccei**

## FOOD, DIET, NUTRITION AND FOOD SECURITY

**Ostrich:** There should be enough food, equitably distributed to all human beings. Rich in nutrition, good in taste, sufficient calories of food should be made available to every one. That should be the global ideal.

**Swan :** Theories of calories, food distribution etc. are based on old values



Human body can work with  
fewer calories

and conjectures that the human body burns food to produce heat similar to a steam engine that burns coal to produce steam to

propel a ship. The human body works in a different manner. It can work with fewer calories of food energy when it is well relaxed. Human body has an enzyme-chemistry that can work miracles, synthesise elements, at ordinary working room temperatures. Human systems can digest food material and absorb nutrients from it with varying levels of efficiency. There can be a “no waste-system” also if a person so wills.

**Parrot :** Still our ideal should be to give as much food to each Indian as an American is getting today. And the whole of India should have strong food security wing.

**Swan :** Americans eat in an inefficient manner, feeding 40-50% of their food grains to pigs, poultry and cattle and consuming animal food. All these living beings are pretty inefficient in converting grains into non-vegetarian food for man. The food grains produced in the world today can feed 250 b. people in the Americans’ eating style, 400 b. people in the Italian consumption level or 1100 b. people at the Indian level. Sooner or later

men and nations have to pay a great deal of attention to their eating styles.

**Ostrich :** We should bring more land under the plough. More fertilizers and better



"We should bring more land under the plough..." biotechnology should do the trick of solving the food problem.

**Parrot :** There is very little scope for more land for grain cultivation. Already environmentalists are crying hoarse that their rain forests are being destroyed.

**Swan :** Food can be grown under less irrigated, rainfed lands, if people are ready to stay fed by coarse grains such as millet, amaranthus, ragi, etc. Otherwise there is very little scope for increasing cropland area or more fertiliser input. Already crop varieties have reached

saturation points of fertilizer intake. Hereafter more fertilizer will not mean more grain output.

**Parrot :** Then breeding technology and science alone can solve our problem. Biotechnology is the only way out.

**Swan :** We are entering a grey area there. Already biotechnologists have expressed concern, that in meddling with



"Environmentalists are crying hoarse..."

the genes of plants and producing hybrid seeds, we are in for surprises, because, what problems these man-made seeds will pose for us we do not know. So far they have proved to be prone to diseases. The way out is to restrict the population, change the eating style, put in hard physical work so as to be able to digest coarse grains. A substantial percentage of human population may have to switch over to vegetarian food from the grain intensive, land-intensive, non-vegetation varieties.

## OVERCOMING INDIA'S FOOD FAMINES

Dr. M.S. SWAMINATHAN

Unprecedented crises are likely within the lifetime of a half of the world's population, arising from such changes as :

- ❖ world population doubling to 10 billion in only 35 years;
- ❖ migration and urbanisation assuming dramatic proportions, with notable consequences on coastal zones;
- ❖ continuing rise of energy consumption exerting increasing pressures on the global ecosystem;
- ❖ climate change, sea level rise and associated impacts on the biosphere;
- ❖ irreversible loss of a substantial part of the total number of living species;
- ❖ continued reduction and deterioration (including chemical pollution) of quality of the natural resource base, including the exhaustion, degradation, salinisation and loss of a major proportion of the world's soils;
- ❖ growing and widespread water scarcity.

Biotechnology can be a powerful ally in the development of avoidance and adaptation mechanisms which can prevent

or mitigate the adverse impact of such crises.

Hence, no further time should be lost in the development of a suitable institutional framework which can foster the growth of a global coalition committed to removing the technological component of the wall dividing prosperity and poverty. Innovative and dynamic institutional structures are essential for dealing with the human implications of a dynamic science.

### FAMINE AVOIDANCE STRATEGIES

In India, the British colonial period began with drought and famine in Bengal in 1770, during which one-third of the population of the province perished. Just prior to the end of the colonial era, another great Bengal famine occurred during 1942-43, when about 3 million people died of hunger. Between 1770 and 1880, as many as 27 scarcities and famines were recorded. Twenty million lives were lost in about 20 famines during the period 1850 to 1900.

The population of the Indian subcontinent (including Pakistan and Bangladesh) was less than 300 million when great famines claimed numerous lives. The 1891 population figure of undivided India was 282 million. Ten million people died in a big famine in 1892. Today, the population of India alone is about 875 million and the population is growing by over 15 million each year. Yet famines have been avoided since the country became independent in 1947. In 1965-66 food production was affected adversely by drought, but there were no famines thanks to extensive food imports, largely under the PL 480 programme of the United States of America. Since the early seventies, the country prevented famines even during adverse weather conditions through a carefully designed food security system involving the maintenance of both substantial grain reserves and an extensive public distribution system. The food grain reserves were built largely from home-grown wheat and rice, since from the late sixties, the rate of growth in food production generally exceeded the rate of growth of population. Timely imports both on concessional and commercial terms were made to replenish stocks in years when they were depleted due to widespread drought. By any standard, independent India's famine avoidance strategy is a remarkable achievement. How did this happen?

Three major groups of factors were involved. First, farm men and women, whether literate or illiterate, took to new technologies with enthusiasm and efficiency, provided they were convinced that the change will help to improve their livelihoods and provided they were enabled to adopt them through appropriate public policies in input pricing and supply and output pricing and procurement.

Second, the country had the wisdom to invest in agricultural research and education and build a national grid of research institutions, agricultural, rural and women's Universities and grassroot level training organisations like Krishi Vigyan Kendras. Not only the Indian Council of Agricultural Research (ICAR), the national agency for agricultural research and education, but the entire scientific community working in the laboratories of the Ministries of Science and Technology, Environment and Forests and Commerce, and the Council of Scientific and Industrial Research (CSIR), Departments of Atomic Energy, Biotechnology, Space, Electronics and Ocean Development, Indian Council of Medical Research (ICMR) and general universities supported by the University Grants Commission did their best to assist rural areas with new technologies. International collaboration also helped much, particularly with institutions supported by the Consultative Group of International Agricultural Research



(CGIAR). Experience has shown that without a strong and dynamic national research system, advantage from international research will be minimal. This was clear from the rapid progress made in the country in wheat and rice improvement based on the initial material supplied by Dr. N.E. Borlaug from Mexico and by the International Rice Research Institute in the Philippines.

A third but vital contributory factor was government policies and programmes in rural techno-infrastructure development such as roads, irrigation, electrification and other forms of energy supply, extension services and markets. Land reforms, remunerative pricing policies, credit supply, development of efficient extension services and various other forms of support to small and marginal farmers became possible due to political will and foresight and administrative action. In the mid-sixties, the country was fortunate to have Shri C. Subramaniam as Food and Agriculture Minister and Shri Lal Bahadur Shastri and Smt. Indira Gandhi as Prime Ministers, who were determined to make the country self-sufficient in food requirement. Administrators like the late Shri B. Sivaraman converted the political vision into practical programmes.

Thus, mutually reinforcing packages of technologies, services and public policies

made it possible for farmers to make the country self-sufficient in food grains at current levels of purchasing power. By the mid-seventies, the challenge shifted from physical to economic access to food. Inadequate opportunities for off-farm employment and inadequate attention to social organisation in rain-fed areas with regard to saving and sharing water and to post-harvest technology, including biomass utilisation, led families without land or livestock or fish pond or trees remain under-employed or often unemployed. India's malnutrition problem thus became largely one of undernutrition or calorie deprivation. It is estimated that over 200 million children, women and men living in poverty now suffer from chronic hunger. While famines have been avoided, chronic hunger persists, and without jobs for all, this problem cannot be solved.

Therefore, the challenge facing the country today is achieving sustainable nutrition security, which involves physical and economic access to balanced diets and safe drinking water to all citizens. Only nutrition security at the level of individual households can ensure that children have an opportunity for the full expression of their innate genetic potential for physical and mental development.

India has now nearly 100 million operational holdings, 25% of the world's

farmers are in India. India has also 20 per cent of the global farm animal population. At the current rate of population growth, India will have over 1000 million people at the beginning of the 21st century. Compounding the problem of increasing economic marginalisation of the rural and urban poor is the growing damage to the ecological foundations essential for sustainable agriculture. Over 100 million ha of potential farm land have undergone varying degrees of degradation. Even now, there is no policy for preventing the diversion of prime farm land for non-farm uses. The same is true of groundwater resources, which are often being exploited in an unsustainable manner. Habitat destruction is leading to the loss of biological diversity. Protecting the already protected areas is proving to be a formidable task. In intensively farmed areas, biotic and abiotic stresses are increasing.

The challenge before scientists, political leaders and farmers is: how can agriculture yield more food, jobs and income in rural areas under conditions of shrinking land and fresh water resources, expanding biotic and abiotic stresses, loss of biological wealth and potential changes in climate, sea levels, and ultraviolet-B radiation? Sharing of research data, processes and products at the international level is also likely to

be hampered in the future, due to the growing privatisation of the applied research in industrialised countries.

Obviously, there is no simple or single solution to the complex ecological, socio-economic and technological problems facing those engaged in promoting sustainable advances in the



The scientific challenge can be faced only through accelerated efforts in the blending of traditional wisdom and modern technologies.

productivity of terrestrial and aquatic farming systems. I can see no way of facing the scientific challenge except through accelerated efforts in the blending of traditional wisdom and technologies and modern technologies. The new technologies of particular interest to agriculture are biotechnology, information technology, space technology, micro-electronics and management techniques.

Ecological injury to basic life support systems and economic injury to over 20 per cent of our people living in poverty, are threatening peace and social stability and are spreading a culture of violence both to nature and to fellow human beings. The action point on poverty alleviation of Agenda 21 of the UN Conference on Environment and Development (UNCED) adopted at Rio de Janeiro in June 1992, states as follows:

“While managing resources sustainably, an environmental policy that focuses mainly on the conservation and protection of resources must take due account of those who depend on the resources for their livelihoods. Otherwise it could have an adverse impact both on poverty and on chances for long-term success in resource and environmental conservation. Equally, a development policy that focuses mainly on increasing the production of goods without addressing the sustainability of the resources on which production is based will sooner or later run into declining productivity, which could also have an adverse impact on poverty. A special anti-poverty strategy is therefore one of the basic conditions, for ensuring sustainable development”.

Most of our rural people depend on agriculture, i.e, crop and animal husbandry, fisheries, forestry and agro-industries, for

their livelihood. We have 25 per cent of the men and women farmers of the world, and also have 20 per cent of the global farm animal population. The per capita availability of arable land is hardly 0.2 ha. Agriculture has to meet the food needs of a growing population mainly by increasing production on land already in use and by avoiding further extension of farming in forest land. Agenda 21 of UNCED has identified the following requirements for promoting sustainable agricultural and rural development.

- ❖ Agricultural policy review, planning and integrated programming in the light of the multifunctional aspect of agriculture, particularly with regard to food security and sustainable development.
- ❖ Ensuring people's participation and promoting human resource development for sustainable agriculture.
- ❖ Improving farm production and farming systems through diversification of farm and non-farm employment and infrastructure development.
- ❖ Land resource planning, information and education for agriculture.
- ❖ Land conservation and rehabilitation.
- ❖ Water for sustainable food production and sustainable rural development.
- ❖ Conservation and sustainable utilisation of plant genetic resources for

food and sustainable agriculture.

- ❖ Conservation and sustainable utilisation of animal genetic resources for sustainable agriculture.
- ❖ Integrated pest management and control in agriculture.
- ❖ Sustainable plant nutrition to increase food production.
- ❖ Rural energy transition to enhance productivity.
- ❖ Evaluation of the effects of ultraviolet radiation on plants and animal, caused by the depletion of the stratospheric ozone layer.

Sustainable agriculture will be possible only with location specific technologies. This in turn will call for the wise use of biological diversity. However, unless a pro-poor bias is imparted in technology development and dissemination, resource- poor farm men and women will derive little benefit from the onward march of science, particularly in the area of biotechnology.

UNDP's Human Development Report of 1992 indicates that over 82% of global income now goes to 20% of the human population. The poorest 20% receive only 1.4% of the annual world income. Such a deplorable situation is true both internationally and nationally and is the root cause of chronic hunger affecting over 600 million children, women and men. Unsustainable lifestyles and unacceptable poverty are both threatening the ecological security and social stability of our planet. Expansion of ethnic conflicts and increased violence to both nature and fellow human beings will be the result of the widening income disparities among members of the human family. A combination of political will and scientific skill will be necessary to arrest and reverse this trend.

***From : Biodiversity, Implications for Global Food Security, Macmillan India Ltd., Madras, 1992.***



## THE ECOLOGY OF FOOD - FOOD SECURITY

### SOME FOOD FOR THE MIND

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R. BALLENTINE

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#### TENSE PEOPLE USE UP MORE NUTRIENTS

**W**e can conclude that the more chronically anxious person who tends to interpret events around him as disturbing will, as a result of more frequent occurrences of those metabolic events that accompany his tense and anxious behaviour use up more of certain nutrients



Tense people use up more nutrients

which are involved in his characteristic responses.

Those who respond psychologically and physiologically with anxiety use up more vitamin B types, C types and B+C combinations. The quantities vary from person to person.

One's mental attitudes and habits of thought have a powerful effect on his vitamin requirements. The resolution of psychological conflicts, the learning of techniques of relaxation, and a reorientation in consciousness which allows one to become calmer and less susceptible to environmental stresses, will reduce requirements of large amounts of B vitamins and perhaps C vitamins.

Given a man's physiological, psychological and emotional limitations, it would be foolish for us to suffer unnecessarily, to exhaust our energy and fail to make progress or experience growth because of certain unusual and exaggerated nutritional demands which we have at this moment satisfying them in a stop-gap arrangement. If it enables

us to maximise our awareness, and our ability to function, then it serves an important purpose and may give us the boost to outgrow this stage of development and move on to the next. If one repeatedly relies on vitamins, he misses an opportunity to come to terms with the habits which have created the problem, the process of change that can modify one's mode of functioning. So he does not require large quantities of nutrients, and all this is essentially a psycho-therapeutic one.

### FOOD SADHANA

Complex variables affect the nutritive value of what one eats. Vitamins, minerals and protein content varies from food to food, from foods grown in one area to another. The value of protein varies with the way in which various foods are combined. The amount of carbohydrate one needs depends upon his activity and his way of life. Each person's needs vary according to his individual make up, his personality and his way of reaching to situations around him.

The amount of food assimilated from that which is taken in depends to a great extent on the functioning of the digestive system. This varies from person to person, from day to day, from hour to hour depending on one's

emotional or mental state. One may secrete more enzymes or less, depending on his state of mind and on his attitude towards the food, what it means to him, how it looks or tastes.

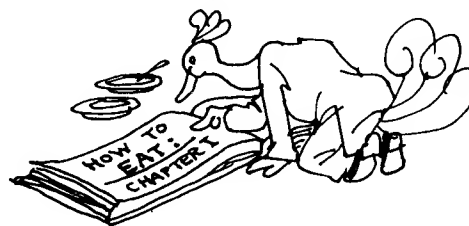
Psychological make up of a person, complexity of diet, biochemical individuality, and unpredictability of daily needs vary. So food requirements vary.

Feedings should be well-spaced, so that food is digested, cleaned, and the digestive tract is ready for another food.

If living habits are reasonably regular and same one will begin to notice that he has certain impulses or feelings that one food or another is not suitable or is just what he needs. Such a subjective sense of what is right can be a valuable guide. This intuitive sense of what is best or what is needed at the moment can be progressively sharpened and refined. One has to find one's way through past conditioning to find out one's realistic needs.

Ayurveda lays down the following rules:

- 1) Eat alone — pay attention to the



taste, texture, and the way it affects your body. Allow time to tune in; consult your body.

- 2) Chew carefully thirtytwo times, once for each tooth; be aware of the food you are eating. Note that the taste of the food varies during the full process of chewing. This helps the body to assess the food quality and quantity.
- 3) Amount : Serve what is appropriate yourself.
- 4) Choose your food.

Regularity of living in the ancient cultures of the East was valued not as an escape from variety and change, but as a way of providing the freedom to experience it.

Sorting out the signals that come from within, and becoming aware of one's non-nutritional reasons for eating results in more than simply getting a good diet. It is a process of self study, self exploration, untangling of past memories and conflicts and a way of coming to terms with them. Working out and overcoming one's cravings involves working out and overcoming deep-seated psychological conflicts. The work with the food, the schedule and the eating, then is the background on which such conflicts may be resolved. Their resolution in terms of food may amount

to their psychological resolution, and thus this process of working through can be therapeutic in a total sense rather than being merely an improvement in one's diet.

This concept is profound. It is said in the East, "he who would attain enlightenment must first conquer the palate". Diet, if approached in the right spirit, can become a means to growth and personal unfoldment. Therefore, a quiet, persistent approach to diet involving self-study and cultivation of increased self-awareness might properly be called "Food Sadhana", "food as a pathway". Pathway towards personal unfoldment and spiritual evolution.

*From the ancient Eastern perspective, consciousness is potentially much more capable of influencing the way the body functions and the way it handles food than the food itself.*

Yet it is interesting that while the Eastern point of view relegates diet to an inferior place in the scheme of variables affecting the human being, it is in the East where diet is managed in the most sane and healthful fashion. The Westerner whose philosophy would suggest that his material being is of utmost importance and that moreover "he is what he eats" tends constantly to

violate all the rules that he has acknowledged lead to good health.

There is a cyclic or spiral-like interaction between what we eat and our consciousness. Mind affects nutrition in numerous complex ways, what was eaten also affects one's clarity of consciousness. Diet helps us to become aware of ourselves.

Both human infants and laboratory animals when allowed to select truly what they will eat, chose more wisely.

### **CHANGING (IMPROVING) PERSPECTIVE OF FOOD**

Throughout the study of food, the emphasis shifts constantly.

- a) a study of soil,
- b) the biochemical constituents of food both arises from the soil and air and water and contributes to the body's nutrition,
- c) transformation of food through digestion and through cooking is crucial to the way the food affected the body,
- d) mind is involved in nutrition and it may be more important than the body

and more important than the food itself in determining our nutritional status,

- e) working to improve one's diet might have its most important impact on the mind and the evolution of awareness, rather than merely on one's ability to get more or less of certain biochemical compounds.

This constitutes a real revolution in nutrition, shifting its focus away from the purely material.

Nutrition cannot be limited to the study of food alone. The digestive system is important and more so the mind, playing a crucial and probably even a major role in nutrition.

- a) The established science of nutrition is not geared to dealing with the mental nutritional interplay.
- b) It cannot see the possibility of a new direction.
- c) Natural food fad is to flee from mechanised and sterile aspects of modern western civilization. It does not recognize the role of consciousness.
- d) Conventional physicians and



scientists believe that nutrition can have important effect upon the mind and mental functioning. But this is still chemistry first, consciousness second.

### **CARTESIAN THINKING**

From the time of Descartes and even earlier mind and body were considered separate and independent.

In the recent decades mind is considered as a product of the brain.

Brain's molecular structure could be manipulated and its environment could be controlled, it was then thought. Orthomolecular psychiatry and drugs could be used to bring about these changes.

Tranquillizers created the impression that mind could be bio-chemically controlled.

Recent study of micro-nutrients has led scientists to believe that mind is the mere outcome of material and physical events. This view threatens to perpetuate an already over mechanistic and materialistic approach to the human beings neglecting the effect of one's mental and emotional habits on nutritional requirements. This view overlooks the other important aspects of nutrition, such as a person's ability to sense, discriminate,

select and to create himself anew through an exploratory experiential approach to diet which emphasises personal awareness and choice.

Eastern perspective on medicine and nutrition counter balances the western extreme. Here food is important but not primary; mind has more influence on nutrition than vice versa. One's attitudes and psychological state affects the way in which he absorbs and metabolises food, or even the *way in which he strings together molecules to form his own nutrients.*

### **LACTATING MOTHERS SYNTHESISE VITAMIN C**

The old concept, a living cell as a spherical membrane full of a water solution with simple compounds dissolved in it is giving way to newer models. It is the interrelationship of various force fields which causes molecules to slip and slide over one another reshaping themselves in ways that produce the metabolic processes taking place within the cell. A cell, is a complex layering of intricate coiled and folded molecules, each intimately related to those around it, the slightest change in their relative position has extraordinarily important ramifications. As a molecule shifts, its energy relationship to

other molecules changes, and the biological reechoes of living matter thereby occur.

The water molecules of a cell are affected by other molecules, and this influence has important biological functions.

An atom or a molecule is made up of complex interactions of energy fields. This kind of analysis, and trying to analyse the non-nutritional substances in the food, leads us nowhere. The subtle and delicate properties of living matter cannot be understood by this method.

The interrelationships between one molecule and its neighbours are intricate. The shifts and modifications in those relationships are delicate and of far reaching consequences.

The purposeful interrelationship between each molecule and its neighbours make for the quality of protoplasm that we call life. Without this web of intricate interactions the movements responsiveness and self perpetuation that we find characteristic of living matter would not be possible.

The chemistry models are based on the study of non-living systems, and does not take into account such properties which are unique to living systems. The living systems react often exactly in the opposite way.

Chemical reactions which occur in a test-tube are based on the principle that loss of energy results as one approaches a more stable but more disorganised state. These chemicals dissolve, they react, but they do not interact in such a way as to form more evolved and complex substances. Living matter however is based on the opposite principle. The tendency of life is to become more organized and energized, not to become disorganised, dissipate energy, or drift into chaos.

There are two basically different principles operating here, and they have been related to the concepts of YIN and YANG. Yin is that which moves outward and dissipates while YANG is that which pulls together and organizes.

Western parallels include Freud's idea of the death instinct and life instinct. The tendency in the material universe to move toward disorganization which we see in chemical reactions and test-tubes is called ENTROPY. But when chemical reactions occur in living matter, they are not governed by entropy. In fact biologists have coined the term negative entropy. It means entropy is not in operation, something opposite is. This other principle moves towards higher organizations toward life and toward intelligence. Though this idea is old, it is only recently that we can point to discrete

biological events that dramatise it so clearly.

### **BIOLOGICAL TRANSMUTATIONS. THE WATERLOO OF REDUCTIONISTS, CARTESIANS, MATERIALISTS**

Louis Kervran, a French scientist who lived in Brittany discovered hens which ate calcium poor and calcium free food and laid eggs that are completely calcified. His studies led him and other scientists to discover that hens produce enzymes that can convert potassium into calcium. This function could be accomplished by enzymes which are known to facilitate transformations that can be effected outside living tissue only through exposure to tremendous levels of energy.

Other studies revealed  $N_2$  to carbon monoxide transmutation, copper into iron are other changes brought about by the enzymes of living organisms.

*"It would seem that our ideas of immutability of our elements is not correct. The more one looks the more he finds examples that support this conclusion. Kervran quotes G.B.Shaw who said that once we decide to change our ideas, we discover not only that there are plenty of reasons to do so, but*



*"... once we decide to change our ideas, we discover that there are plenty of reasons to do so -- and they have been staring at us for a long time..."*

*those reasons have been staring us in the face for a long time".*

Kervran's research in the African desert revealed that oil workers there put out each 4 litres of perspiration sufficient to absorb 2200 calories of heat each day. But the heat generated by each man's work was 4000 calories per day. The workers ate a lot of sodium chloride (tablesalt) every day and put out huge amount of potassium through the sweat glands. Conversion of sodium to potassium is an endothermic process that used up the extra heat of about 1800 calories per day per worker. They were also converting the in-taken sodium into magnesium spending away bodily heat. Here the nucleus of the concerned atoms themselves have been altered such changes otherwise known to

occur at tremendously high temperatures such as those of atomic reactors were occurring at body temperatures in the workers or even less. Kervran called these reactions, BIOLOGICAL TRANSMUTATIONS, caused by enzymes. The intricate enzyme molecule has the power to gently manipulate atoms so that they merge without the brute force of massive input of energy.

With the clear documentation that living systems have the ability to completely change one form of matter into another, the *field of Nutrition is drastically changed.*

That man's mind affects his eating habits is recognized even by the average nutritionists and dieticians. That is emotional and mental make up might affect his digestion, his absorption and even the character of his metabolism is recognized only by a minority of physicians.

That the unconscious as well as the conscious mind may tune the metabolite machinery to change vitamin requirements, to create certain vitamin or more amazingly yet to transmute one element into another is understood only by a handful of biophysicists.

BECAUSE OF THE STUBBORN CLINGING TO THE IDEA THAT THE

PHENOMENON OF CONSCIOUSNESS MUST ARISE OUT OF A MATERIAL BASE, WESTERN SCIENTISTS ARE HARD PUT TO DIGEST THE DATA COLLECTED BY SUCH RESEARCHERS AS KERVAN. IT WILL REQUIRE A REVOLUTION IN PHILOSOPHICAL THINKING FOR WESTERN SCIENCE TO APPREHEND THAT THE PHYSICAL ELEMENTS OF WHICH LIVING MATTER IS MADE CAN BE THE PRODUCT OF INTELLIGENCE RATHER THAN THE ORIGIN OF INTELLIGENCE.

*As Kervran says :*

The entire genesis and evolution of our planet needs to be restudied in the light of transmutation, which opens new horizons to geologists and philosophers as well as to meta-physicians. The latter can find grounds for meditation in the fact THAT THE VITAL PHENOMENON OF LIFE IS NOT CHEMISTRY ALONE.

What is necessary now? A reorientation along the lines of Eastern philosophy. The world of material phenomena is but a manifestation of that which is subtler. This implies that the reshaping of consciousness work with the psyche, meditation etc is potentially the most powerful tool for altering the

functioning of the human body. This opens new vistas for practising medicine.

In the East traditional philosophy holds that consciousness is able to alter matter and it is widely regarded as proven, that certain famous spiritual masters, were able to exist without food for years. Kervran's work shows how they did it? Now all the essential elements could be derived from the air which one breathes, if one has the sufficient mastery over himself to allow it to happen.

The possibility of alchemists working to transmute one element to another acquires a new ring of truth in the light of Kervran's work.

When mind influences nutrition through many ways, and nutrition influences the mind, in equally complex ways, then our cause and effect reductionistic thinking becomes as out-moded as the use of 19<sup>th</sup> century physics for dealing with space travel.

It seems increasingly likely that if we are to find a philosophical framework that will accommodate all we have learned that is relevant to nutrition, if we are to develop a base on which we can build a more comprehensive and holistic science of nutrition, we should probe into some of the ancient philosophical systems

from which have evolved the more holistically oriented traditional systems of medicine, yoga and meditation—disciplines where the emphasis has always been on personal experience and an integrated under-standing of all facts of human nature.

### THE EATING MIRACLE

There is a story told in the East of two fakirs who had spent years in seclusion



studying yoga, having learned extraordinary feats of physical and mental control and mastery of their minds and bodies. Standing on the banks of the Ganges, they fell into one another's company, and in the course of their conversation one of them happened to imply that he had developed the ability to do more miraculous things than most, probably including his companion.

The other fakir, a bit older and perhaps a bit wiser rebuked him gently,

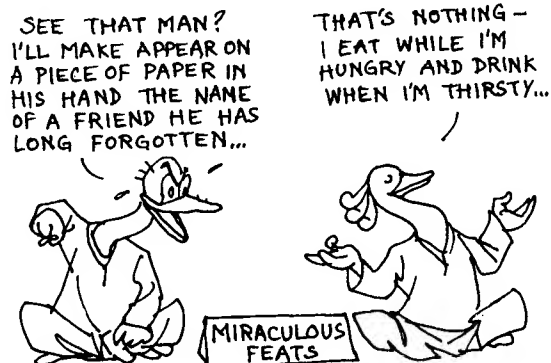
wondering whether he might not be carried away by a moment's boastfulness. But his new found friend bristled with pride and volunteered to demonstrate what he could do.

The older man agreed to this "Go ahead" he said. The younger proceeded "See the man across the river? I will make appear on a piece of paper in his hand the name of a friend, whom he has long forgotten".

The older man smiled. "Is that really the sort of thing you do? That is nothing".

The young fakir replied, now with some heat, "Oh, really that is nothing? Well, please tell me, what sort of miraculous feats do you accomplish?"

The first fakir looked at him calmly and his eye twinkled, "I eat when I am hungry and drink when I am thirsty".



If one can eat only when hungry and yet, at the same time take his meals with reasonable regularity and at proper intervals, he will have met one of the greatest challenges of good nutrition.

***From : Diet and Nutrition***



## CHEAP FOOD AT GREAT COST

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HRH THE PRINCE OF WALES

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**T**he illusion has been maintained that intensive farming has given us cheap food. But the real sums are never done.

I was delighted to be asked to give this year's lecture in memory of Lady Eve Balfour, in the Fiftieth Anniversary year of the Soil Association.

In 1946, when the Soil Association was formed, the mood of the nation was quite different. Our country had just emerged from a war during which our isolation had forced us to produce as much food as we possibly could, from our own resources. Science and technology had helped us to win that war and it was perhaps not surprising that people gained the idea that science could do almost anything for humanity. And where better to apply those new-found skills than in food production? One new development followed another with bewildering speed and it must soon have seemed as if our mastery of modern science could increase output, banish weeds, pests and diseases and keep us one step ahead of whatever temporary setbacks might arise, *indefinitely*.

The prevailing mood during the last fifty years has been that human beings can dominate Nature and win; that human beings are not only at the top of the food chain, but that manipulation and domination of the natural world is somehow our destiny, even our duty. That, I think, is where things have gone wrong.

The Kentucky farmer and philosopher, Wendell Berry, summed up what I believe to be the true situation when he wrote:

"Farming cannot take place except in Nature; therefore, if Nature does not thrive, farming cannot thrive. But we know too that Nature includes us. It is not a place into which we reach from some safe standpoint outside it. We are in it and are a part of it while we use it. If it does not thrive, we cannot thrive. The appropriate measure of farming then is the world's health and our health, and this is inescapably *one* measure."

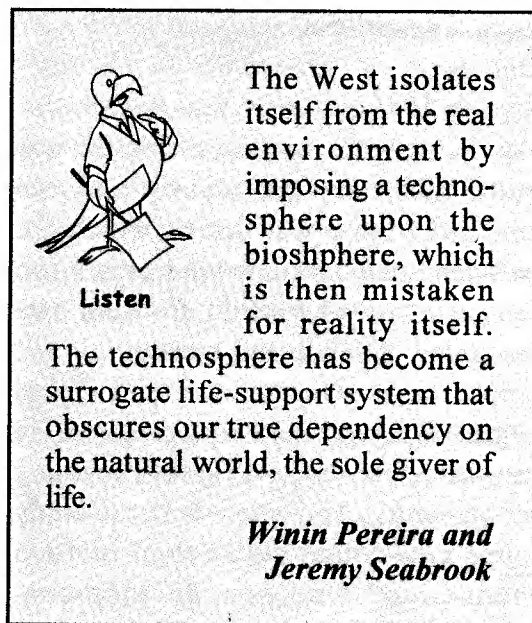
Only now is the evidence of that measure beginning to emerge from the

process of the progressive industrialization of agriculture. And the results look profoundly disturbing. Today we are surrounded by evidence of what has happened to our farmland when husbandry-based agriculture is replaced by industrialized systems and where traditional management gives way to specialization and intensification. We see the consequences of treating animals like machines; seeking ever greater "efficiency" and even experimenting (catastrophically, as we now know) with totally inappropriate alternative "fuels" - in the form of recycled animal proteins - with which to "power" them.

All these things have been consistently drawn to our attention by environmental and animal welfare organizations. Their concerns are based on fact, data and analysis as much as on popular and emotional concerns. They speak tellingly of lost biodiversity, of ploughed-up pastures and species-rich mixed farms turned into impoverished arable acres; of huge reductions in the populations of birds such as the skylark and song thrush, and of many of our wild flowers; of polluted watercourses and, in places, of depleted and eroded topsoil. They horrify us, when we can bear to listen, by telling us that dairy cows - with a natural life expectancy of twenty years or more - are now quite literally milking themselves to death by the time they are six or seven, worn out by

producing more than their own body weight in milk every month, and suffering from a lethal combination of distended udders, lameness, chronic mastitis or infertility; despite the routine use of preventative applications of antibiotics and other drugs to control diseases, leading to resistance and the use of ever-stronger drugs.

It is no good looking for positively identifiable culprits for these horrors, except perhaps our society as a whole - for failing to value properly our natural



assets, and the traditional, tried and tested ways of utilizing them, until they were nearly gone. And, incidentally, for comprehensively abandoning that sense of



the sacred which is ultimately the only realistic limit to the arrogance of our ambition. It would certainly be quite wrong to blame farmers for responding (as they could hardly fail to do) to the clear economic signals they were sent. So I hope we shall hear no more talk of vandalism - implying wilful damage. But, at the same time, it is difficult to over-emphasize the significance of what has been *unwittingly* destroyed in only two generations. The loss has been gradual, insidious, just slow enough for us to convince ourselves that the lost rural idyll some of us may remember from our childhood was probably just a rose-tinted and romanticized dream. Perhaps in some respects it was, but, unfortunately, the losses are all too real. Degraded environmental capital is not something one can easily reinstate. We have burdened ourselves and our children with the task of rebuilding what we have destroyed. I fear it may take them most of their lifetimes to do so. And the cost, both for us and for them, will be immense.

I need hardly mention the case of BSE, which the Ministry estimates will have cost taxpayers £ 1.4 billion by the end of this year in slaughter, compensation and related costs, not to mention the loss of public trust in science and the regulatory framework-and the personal suffering of so many individual farmers and their families.

But there are other equally dramatic examples of public expenditure *now*, made necessary by public expenditure in the past. It is estimated that £ 1 billion of capital investment would be required by the water companies to remove pesticides from drinking water; but, in addition, the monitoring and removal of pesticides from contaminated water supplies is already costing us £ 121 million every year. Nobody knows what the future costs will be of so much officially sanctioned use of organo-phosphates and organo-chlorines, or of the routine dosing of livestock with antibiotics. In addition, there is the huge but unquantifiable loss of landscape quality, wildlife and cultural diversity which reduces our genetic resources, depresses the human spirit and makes all our lives less interesting and less fulfilling.

These hidden costs have never been linked to the price of conventionally grown food. The illusion has been maintained that intensive farming practices have, at least, given us cheap food. But the real sums are never done. If you add in the production subsidies, the degradation and loss of our environmental capital, and all the costs of cleaning up, then what started out looking like cheap food is actually nothing of the sort. Agriculture contributes about 2% to our economy, but produces 10% of the acid rain and 4% of greenhouse gas emissions.

Fair competition, in the shape of a “level playing field” and proper application of the “polluter pays principle” - difficult though that might be - would make things look very different. At the moment, I believe, we tend to look at only one side of the balance sheet, thereby making it difficult for ourselves to reach a balanced judgement on the costs and benefits of current agricultural systems. Is it not time to remove these distortions and give those farmers who have opted to farm in a less intensive fashion, and who by and large don’t inflict those hidden costs on the rest of us, a fair chance to compete in the market place on equal terms?

But are there yet more costs - nutritional costs - of intensive agriculture which should be taken into consideration? The scale of the damage on the environmental front is something we can often gauge with our own eyes. But the relationship between the quality of food from intensive agriculture and human health has been less obvious.

The *New Scientist* recently reported alarming research results from a study of the long-term effects of the so-called “green revolution” in South Asia. New plant varieties fed with high levels of artificial fertilizer have dramatically increased food production, to no-one’s surprise. But it now becomes clear that those intensively grown crops are nutritionally deficient. They lack vital

trace elements and minerals, particularly iron and zinc. This deficiency has been passed on through the food to such an extent that an IQ loss of ten points has been observed in a whole generation of children who have consumed a diet largely based on crops grown in this way. To quote the *New Scientist*:

“... even as the food supply in some countries has increased, so has the number of people suffering incapacitating vitamin and mineral deficiencies. This is threatening to lock



Food supply has increased -- so has the number of people suffering from vitamin & mineral deficiencies.

parts of the Third World into an endless cycle of ill-health, low productivity and underdevelopment.”

If this is the way a responsible journal describes the effect of high input agriculture in Asia, could we expect to see the same thing in the West? The answer, of course, is that we simply don’t know, and I find that

profoundly worrying. There is evidence, admittedly from studies of laboratory animals, that the effects of a nutritionally inferior diet are not always apparent at first. It is sometimes only in the *second* generation that a greater susceptibility to disease and a rising level of infant mortality start to appear. It may also be that any inadequacies in our own food will be masked by the varied nature of our diet, or even by the increasing proportion of vitamin supplements we are constantly being encouraged to swallow. But there is already a well-documented and, as yet, unexplained decline in male fertility in many European countries, which some people believe may be linked to diet.

In the light of this evidence, circumstantial though it may be, it is surely imperative that further research is conducted into the real nutritional quality of food grown intensively in this country, and into the real costs of the possible side-effects of chemical farming. Will we, perhaps, end up paying through the Health Service for the so-called cheap food produced in this way? If so, it is clear that the poor, the elderly and people prone to illness will suffer disproportionately.

Now, although there seems to be little dispute about the need for a change of direction in agricultural policy, the debate is still raging about the best way ahead. There is an increasing consensus among the

environmental groups and they have sought practical and constructive dialogue with farming organizations and government. But, incredibly, there are still people elsewhere who believe that we can “feed the world with plastics and pesticides”, that we should intensify even further on the so-called productive land and turn the rest into nature reserves. There are those who believe that the consequences of the GATT, which will assist the globalization of trade in agricultural products, will be wholly beneficial, with the fittest surviving in a glorious utopian era of perpetual growth. And then there are those who revel in the prospect of harnessing the awesome power of biotechnology to assist the relentless progress of high-tech agriculture. I suspect that few of you will be surprised to hear that none of these features in my vision of sustainable agriculture! - or of sustainable anything else, for that matter!

Of course, biotechnology and genetic engineering are aspects of a particularly emotive subject, and I do not intend to stoke those emotions tonight. I shall content myself with quoting from the January, 1996 report of the Government's Panel on Sustainable Development. They acknowledge, as I do, that genetic manipulation could lead to major advances in medicine, agriculture and the good health of the environment. Then they go on to say, crisply and clearly, that:

“Once released... a GMO (genetically modified organism) cannot be recalled: the action is irreversible. More than in other areas there is uncertainty about the long-term outcome.... Introduced genes may over time spread to other organisms with consequences that cannot necessarily be foreseen.”

And they end with a stark warning:

“Unfortunately there are many recent examples of failure to anticipate problems arising from the use of new technologies (such as CFCs, asbestos, pesticides and thalidomide). Potential consequences are more uncertain where self-replicating organisms are introduced into the environment.”

We have now reached a moral and ethical watershed beyond which we venture into realms that belong to God, and to God alone. We live in an age of rights – it seems to me that it is about time our Creator had some rights too.

At the moment, as is so often the case with technology, we seem to spend most of our time, establishing what is technically possible, and then a little time trying to establish whether or not it is likely to be safe, without ever stopping to ask whether it is something we *should* be doing in the first place. I believe that biotechnology is so

powerful and so far-reaching that we should seek ways of engaging a wide range of people and interests in a thorough ethical debate about how and where it should be applied.

For the last fifty years we have given our farmers a remarkably narrow set of goals, and accompanying incentives to help them get there: economic performance without environmental accountability; maximum production without consideration of food quality and health; intensification without regard for animal welfare; specialization without consideration of the maintenance of biological and cultural diversity. The signals we sent said what we wanted: cheap food and plenty of it. We can hardly blame our farmers now for their outstanding success in achieving those goals. But if we want to modify and add to those goals in the light of experience and changing public expectations, we are only going to be able to do so with the support of a further reformed Common Agricultural Policy (CAP).

Historically, vast amounts of money have gone into the CAP; but unfortunately the expenditure of it has not been modified sufficiently to keep pace with the many changes in technology, environmental impact and social concerns that have taken place in recent years. For instance, in 1995 only 2% of total CAP expenditure was spent on supporting agri-environment

schemes, despite the fact that surveys show that most consumers would not put “Green” farming right at the top of their priority list for CAP support.

There are some people (notably the free marketeers who are wholly in favour of the GATT and the further globalization of trade in agricultural products) who would prefer to see the CAP abolished altogether. For this group, farming has no special claim to be treated any differently than the steel and mining industries. But they are still, thank goodness, outnumbered by those who recognize that agriculture is unique, with responsibility not only for feeding us, but for custody of a precious natural resource, as well as cultural and social dimensions that cannot be ignored. Farmers play a crucial role, not only in safeguarding the health of the nation and the environment but also in maintaining the vitality and viability of our rural communities. Few would dispute the need to encourage farmers to become more responsive to their markets, but if we want farmers to adopt more environmentally sustainable methods, it is clear that we could use the mechanisms of the CAP to encourage moves in this direction, just as we used them in the past to encourage maximum production.

There are always going to be aspects of farming, such as maintaining the fabric of our landscape, where the costs cannot easily be passed on to the consumer. It is difficult to

ignore evidence such as the recent Gallup poll which showed that “the countryside” came second only to “free speech” as the attribute most valued in Britain today. Yet it is impossible, and counter-productive, to attempt to attach a monetary value to such intangible aspects of our existence. So we need to find new ways in which *all* farmers can be supported for providing services to society as a whole. There seems to be a growing consensus that the best way would be to make specific payments to farmers who commit the whole of their farms to environmentally sound methods and to ensuring food safety, nutritional quality and animal welfare. This might form the heart of a future Common Agricultural Policy.

At a practical, measurable level, I was fascinated to see Nic Lampkin’s study of the extent of organic farming in Europe. Under exactly the same CAP regulatory framework, there are wide differences in how much has been achieved. Several countries, including Sweden, Denmark and Germany, expect to have at least 10% of their land area in organic farming by the year 2000.

Sadly, the word sustainability itself is in danger of taking on rather technical connotations. It is an important word in more than a technical sense. There is an element of circularity to it. We must sustain the world if it is going to sustain us. We must act generously towards the soil



**We must sustain the world  
if it is to sustain us.**

which has been generous to us. Our lives are not sustainable if the world in which we live is not itself sustained - by us. If we come to understand that again, a certain dignity will return to our lives. We will no longer regard our planet as a treasure chest to be raided at will, but as a world that will nurture us if we will nurture it.

I am *not* interested in returning to the past, and that applies - I might as well tell you - whether I am talking about farming, architecture, education, or complementary medicine! What I do believe, passionately is that we should *learn* from the past, accept that there are such things as timeless principles, operate on a human scale, look firmly to the long-term, respect local conditions and traditions, and be profoundly sceptical of people who suggest that everything new is automatically better - invariably it turns out to be a short-lived, fashionable approach anyway. It is also instructive to look to see where the proponents of such ideas are getting their research grants!

***Prince Charles farms organically at  
his High-grove Estate.***



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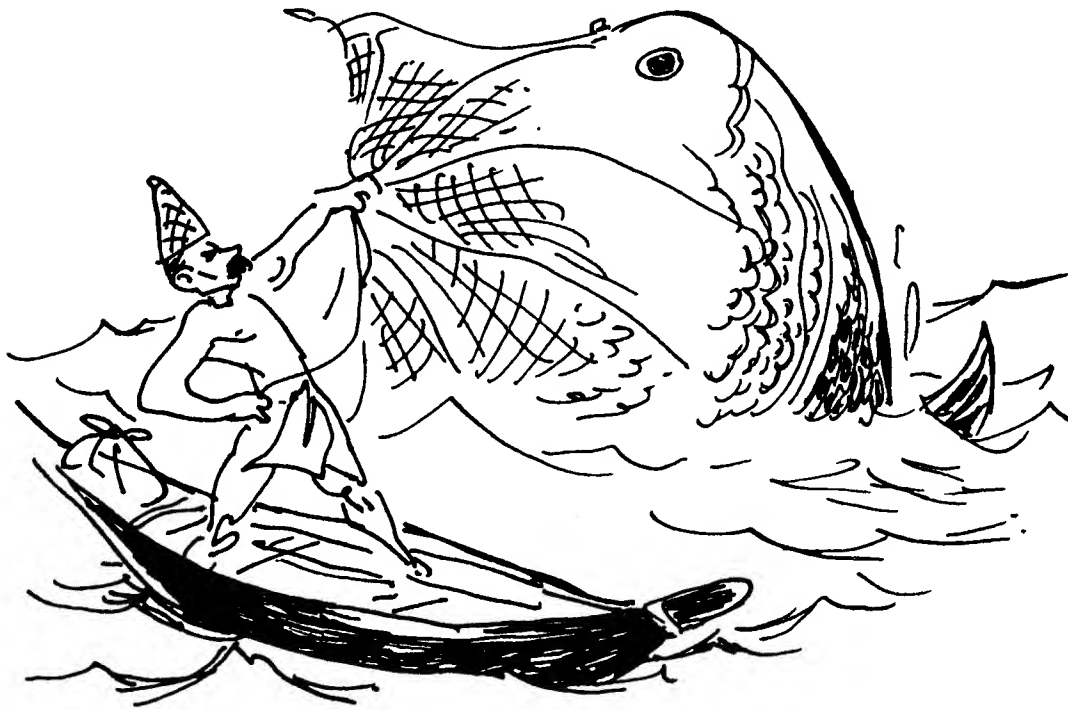
## THE FISHY MATTER OF FISHING

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PETER WEBER

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- 1) The world catches 100 million tons of fish per year.
- 2) Fish and other sea products account for 16% of the world's consumption of animal protein, 5.6% total protein intake.
- 3) Fish the poor man's protein is becoming a costlier luxury.
- 4) One billion Asians rely on fish for protein.
- 5) 13 out of 15 major fishing regions of the world have recorded drops in the catch.
- 6) Pollution and destruction of habitats of fish in rivers, bays, estuaries, coastal wetlands, coral reefs, and semi enclosed seas have endangered fish and all marine life.
- 7) The world has 15 to 21 million fishers. 100,000 of them have lost their jobs in the recent years. 10 million of them may lose their jobs, if the present decline persists.
- 8) South Asian countries, Chile in Latin America, Iceland, Canada, and South Pacific Island, are areas where economy and employment depend upon fishing.
- 9) Today there are 1.2 million large fishing boats in the world. Many European nations have 40 to 60 percent over-capacity.
- 10) In Kerala, subsidies to fishermen for purchasing boat and equipment helped only the rich and the organised.
- 11) Today, there are too many fishers chasing too few fish. Unemployment within the fishing sector is increasing.
- 12) There are two classes of fish consumers:
  - a) Small catchers with fish as regular diet; and
  - b) Market consumers who influence the fish processing industry.
- 13) The world's top marine fishing nation, Japan, is also the number one importer of sea food.



**Fisheries**

- 14) Inland and marine fish farming cannot take the place of wild marine supply.
- 15) Over-capacity, border disputes and local over-fishing, are the other

problems. Fishery management is an urgent necessity.

***From : State of the World 1995.***



## PROMOTING SUSTAINABLE FISHERIES

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ANNE PLATT MC GINN

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**F**ishers across the world are suffering from both resource depletion and excess capacity to catch available fish as measured in terms of boats, nets and fishers. Fishers for long had their own local codes against overfishing, now ignored by international agreements.

Conflicts between large and small scale fishers and the impulse to catch all the fish available are global problems. The world's total fish catch is 116 m. tons with one-fifth being raised on farms. Most marine fisheries are in danger of severe depletion.

As the more valuable species are overfished they are replaced by less desirable ones. Smaller and smaller fish are getting hauled up -- an act of eating up the seeds and seedlings.

Marine eco-systems are getting degraded because of 1) human activities, 2) land and airbased pollution, 3) habitat conversion -- degradation and destruction, and 4) climate change. Today 3.8 billion people, 60% of the world, live within 10 km from the coast interfering with the life in the sea.

Coastal and estuarine eco-systems are downstream from farms and cities. Often they are the collecting points for water and runoff. Eutrophication caused by excessive levels of nutrients, seasonal algal blooms, toxic growths, shading by growths etc. affect fish growth and the health of fish. Often "dead zones" are created, killing all marine life in an area. Spawning, growth and stock replenishment of fish are adversely affected. It is estimated humans remove as much as 8% global marine productivity from coastal areas, 35% from monotropical continental shelves, and 2% from the open ocean.

Decline in one species can trigger a cascade of effects throughout a marine ecosystem by altering predator -- prey relations, changing community structure, functions, and productivity and rendering a system vulnerable to invasive species.

The type of fishing gear used and the size of the fishing vessels both play an important role in the health of fisheries, and the marine ecosystem. Often, unwanted species are brought on board and then thrown back to sea dead or dying. These unwanted

species called “discards” are wasted. F.A.O. estimates that annual discards total 27 m.tons, one-third of total catch. This unintended catch is associated with more industrialised fisheries.

Trawl fishery, small meshnets, use of cyanide poison - fishing gears and methods are other factors causing unintended catch and kill.

Overcapacity of the fishing industry drives over fishing. Open access removes constraints and controls.

Overfishing has contributed to a vicious cycle of economic hardship and social

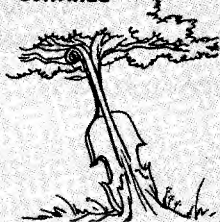
disruption among the fishers of the world.

To manage the fishers, limited access, returning to sea tenure systems, community based management, evolving alternative employment systems, better enforcement and monitoring, reducing by catch (unintended catch), enforcement of the principle of “let the polluter pay”, protecting habitats, and juvenile and seasonal fishing closures, are the methods suggested.

With timely action, fisheries can continue to provide food, jobs, and enjoyment for millions of people worldwide.

### “DO NOT WASTE” - ANT

Music should  
continue



*Raja was in his study doing his homework when he saw a black ant trying to grab a large grain of sugar that was lying on the table.*

*Raja moved the grain away with the tip of his pencil.*

*The ant stopped and again moved towards the grain of sugar.*

*Raja promptly moved it again. But it fell off the table. The ant stopped and in a tiny shrill voice told Raja. “This is not fair. We have to work for every bit of food that we eat. We do not waste food as some of you people do.”*

*“I am sorry,” Raja said, and he bent down*

*to look for the sugar grain but he could not find it.*

*“Never mind,” the ant said. “I shall find it. All I wanted to tell you is that you should not waste food. There are many young children who are poor and do not have enough food although they work as hard for their living as we ants do.”*

*Raja felt a bit ashamed because he often left food on his plate or milk in his cup and he hadn’t realized how others had to work hard for their meals.*

*“And if you don’t mind my telling you,” the ant continued, “I often notice that you do not switch off the light and the fan when you go out of the room. You just waste energy. Anyway, I must not waste my time. Good night,” and the ant hurriedly moved away.*

## VEGETARIANISM, THE ECONOMIC FACTS

PROF. A. SRIDHARAN

**T**his is in reply to the article in the *Hindu*, "Total vegetarianism - how practical?" (September 16).

The article claims that if all Indians become vegetarians we would need twice the quantity of foodgrains consumed now. This implies that 50 per cent of our calorific requirement or half our food, is met from meat. The fact is that only 5 per cent of our calorific requirement is met from meat (National Average, Refer: Reader's Digest Great World Atlas, 'What the World Eats'). Though a majority of our population is theoretically non-vegetarian, only the very rich can actually afford to eat meat regularly, since it is

expensive - chicken costs over Rs. 60 a kg and mutton over Rs. 120 a kg. So there is no question of the "cent per cent" increase in foodgrain requirements. One wonders how that conclusion was arrived at. Further, the irony is that foodgrain supply will actually increase and become less expensive in a vegetarian scenario, simply because it takes about 10 kg of grain to produce 1 kg of chicken.

Most chicken, in India, are professionally produced in poultry farms where millions of tonnes of grains - corn, ragi and various millets - are used. If you raise goats the ratio becomes even worse, one kg of mutton requiring about 100 kg of grain. One might argue that most goats are not fed grain but are left to graze. In that case, they compete with cows for precious fodder, increasing the price of milk. Statistics of the Ministry of Environment, Government of India show that over one-fifth, 20 per cent, of the land in India has been degraded, one of the main reasons being over-grazing by goats (apart from other reasons such as deforestation). About 60 million hectares of land has become scrubland losing the top soil



in various degrees; and thus becoming unfit for agriculture in so many States including Rajasthan, Karnataka and Madhya Pradesh. Many parts of the Himalayas have lost their soil cover, as goats have over-grazed their steep slopes in the Himachal Pradesh and Uttar Pradesh, leading to erosion, floods and siltation of rivers. But for the regular meat consumption of a minority rich population, nearly 20 million hectares of prime agricultural land would have stayed under food grain.

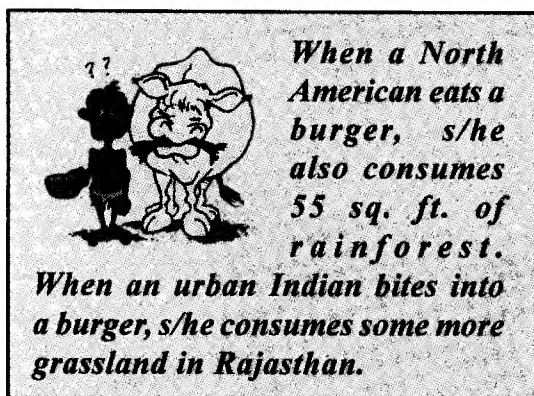
To put it in a nutshell, food grains, fruits and vegetables would be much cheaper but for the need to feed chicken and goats. The poor will find ragi, corn, millets and wheat much less expensive under such circumstances. A third and not very-well known fact is that much of the slaughter is not to feed the hungry in India, but for export to West Asia. One might lose a little foreign exchange but the poor in India will find food easy to obtain. We produce and export leather only because most other countries in the West do not want the highly toxic, polluting

leather industry on their own soil. The Supreme Court is making valiant attempts to help over a million people in the Ambur-Vaniyambadi belt in Tamil Nadu where land, water and air have been contaminated beyond redemption by hundreds of tanneries.

Any loss in export earnings could be made up through the export of textiles, engineering goods and many other products in which the country has already done well.

In the U.K., 90 per cent of the agricultural land is used to grow food for livestock. The U.K.'s population is 60 million. If the land were cultivated to grow food for the people instead, they could feed 250 million people!! (Data - Ministry of Agriculture, the U.K.). If the U.S.'s massive output of corn, used to feed cattle for beef, is released into the international market, corn prices would fall by half. The demand for meat in the U.S. is so great that vast stretches of the South American tropical rain forest are cleared and used to farm cattle, causing damage to the world's ecosystem (Ref. Biodiversity Convention at Rio, Brazil). It is clear that meat-eaters are not doing a "social service" helping the poor to get their vegetables. Because of meat-eaters, vegetables are expensive for the entire population.

According to the Central Government Department of Agricultural Statistics, one hectare of land can yield 20,000 kg of





One hectare of land can yield 20,000 kg of potatoes. The same land used for animal fodder yields only 50 kg of meat.

potatoes. The same land used for animal fodder will yield only 50 kg of meat.

As for protein, 1,000 hectares of soyabean yield 1,124 kg of usable protein, 1,000 hectares of rice yield 938 kg and 1,000 hectares of maize yield 1,043 kg. A

buffalo fed with all these put together will yield only 60 kg of protein. Scientists at Harvard University have concluded that reducing meat production by just 10 per cent will release enough grains and vegetables to feed 60 million more people. Meat eating is closely related to world hunger.

Over - populated countries such as China and India are managing to feed their hungry hundreds of millions only because of a largely vegetarian diet. If all Indians eat meat every day, even the resources of the whole planet will not be enough to support us.

*Courtesy : The Hindu, Oct 1, 1996.*



## EAT LESS, LIVE LONGER!

### SPEAKING OF SCIENCE

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D. BALASUBRAMANIAN

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*The Hindus have their vratham and upavasam and taboo against beef, Muslims have their halal, roza and taboo against pork, Christians have their Lent and the practice of only fish on Fridays, Jains have their avoidance of garlic, onion and meat in any form, and Buddhists never eat to a full stomach but stop when half-full.*



Just about every community has some edicts on what people should eat, what they should not, how to eat and how much to eat, and when and how to fast. The Hindus have their vratham and upavasam and taboo against beef, Muslims have their halal, roza and taboo against pork, Christians have their Lent and the practice of only fish on Fridays, Jains have their avoidance of garlic, onion and meat in any form, and Buddhists never eat to a full stomach but stop when half-full. Having been raised in Tamil orthodoxy, I was struck, when I first came to know the Jewish people, by the similarity between our dietary practices and their elaborate rules on keeping *kosher* (which goes far beyond halal).

Central to all these is the practice of periodic fasts and the emphasis on dietary moderation and occasional abstinence. This has been rationalised in several ways - empathy towards the less privileged, giving the body some rest, practising the golden rule of moderation (see Kural verses 95:1 and 95:6), it adds to your virtues and helps you on your path to salvation, helps you live longer and so on.

Physiologists and dietitians have long suspected that eating in moderation - caloric restriction is the technical phrase that says the same thing - may be beneficial to the general health of the body. Experiments with animals have produced the tantalising result that caloric restriction (abbreviated as CR) may slow down the aging process and help the body retain its youthful features! Of course, when the animals are given restricted diet, it is with respect to the overall caloric intake; they are not deprived of their vitamins and micro-nutrients.

What would be the basis of this antiaging effect of caloric restriction or CR? Dr. Richard Weindruch, who is now at the



### Benefits of Fasting

VA Hospital and University of Wisconsin in Madison, has been looking at this question for some time and has published a book called *The Retardation of Aging and Disease by Dietary Restriction*. In a paper published in the *Journal of Nutrition* in 1987, he and his colleagues found that CR without any deficiency in essential nutrients, retards aging and extends life in all species that have been tested so far.

Susceptibility to diseases was lower, survival curves extended longer and all physiological indices of aging turned for the better. The mechanism by which these beneficial effects are caused was shown to be multifold: (a) a better primed immune system (b) a more efficient metabolic rate, (c) increase in the levels of molecules that remove or detoxify the highly reactive free radicals and other poisonous substances that accumulate in the cells, (d) more efficient repair of damage that occurs to the DNA contained

in chromosomes and in mitochondria, (e) higher levels of protein synthesis, and the turnover of damaged or chemically modified proteins and so on.

All these mechanisms are common at the cellular level to all animals, which explains why CR is beneficial to diverse families of animals.

While we can study any species in these experiments, the favourite animal that is used as a model in this connection is the laboratory mouse. It is small, breeds fast and delivers a handful of babies each time, and has a short life span. With its longevity of no more than 40-45 months, a mouse is called aged when it is but 3 years old, and middle age hits it at 11-15 months of age. It has a good immune system, good loco-motor activity, learns fast, and is inquisitive. It does not eat a lot; a typical high calorie diet for a mouse is about 120 kilocalories per week. CR here is halving the supply to 55 k calories/week. (In comparison,



a man eats 2300 k calories per day-what the mouse eats in about six months). Genetically speaking, the relation between the chromosomes of the mouse and their equivalents in man has been worked out. Thus, the effect of CR on the brain and the brain power of man are modelled using the mouse.

In such experiments, well-fed and CR mice were compared in their motor coordination (run wheel cage, roto rod) and learning abilities (running a complex maze). As the mouse ages, it performs poorly in all these tests - but diet restriction or CR was seen to increase loco-motor activity and learning both in middle - aged and elder mice; CR however did not affect exploratory activity in a novel arena. In other words, it does not seem to greatly enhance inquisitiveness, at least in mice.

It does seem to increase life span though; one out of every ten mice that were on a 65 per cent CR (about 40 kcal/week) lived on to become a Mouse Methuselah - 53 months - exceeding the value of any mice of any strain. CR improved immune response and made the animals less susceptible to cancer. In addition, CR appears to help in fighting the ill effects of damages caused by oxygen related toxic compounds called free radicals.

As we use oxygen in our cells to produce energy, we also end up generating

small quantities of these reactive oxygen radicals which react with and chemically damage various molecules in the cell and render them defective.

The body detoxifies these oxygen radicals by means of special enzymes and compounds called anti oxidants. It is like we need the fire for energy but it can also damage us if not controlled. As the body ages, its ability to protect itself from oxidative damage drops. Indeed, as Dr. Earl Stadtman of the National Institute of Health has pointed out, protein oxidation is directly correlated to aging and senescence, and to the incidence of diseases such as cataract, arthritis, Alzheimer and so on. It is in these matters that caloric restriction appears to be hopeful.

It is clear that the effects of CR are not on one or two proteins or genes, but on a large number of them, since the benefit is seen on oxidant defense, protein synthesis, tumour regression, immuno-modulation, DNA repair and so on.

In other words there can be no single CR effect gene, but an array of them. This is made clear from a study a human patients who suffer from what is called the Werner Syndrome. These people age prematurely and are susceptible to a number of major age-related diseases. Gene analysis of some Japanese patients, done by Dr. G.D. Schellenberg of Seattle, revealed the presence



of defective DNA metabolism and nonsense mutations in them.

In order to examine the molecular mechanisms associated with aging in animals on the one hand, and the effect of caloric restriction on the other, it would be desirable to compare the gene expression in these with those of normal animals. This has been done most recently by Weindruch and collaborators, and published in the August 27 issue of *Science*. In order to identify the genes involved, the group has made use of remarkable new technology called the DNA array microchip. Here, appropriate probe sequences for over 6000 genes are attached chemically on to a quartz surface, in a two-dimensional comb-like arrangement. Extracts from the animal tissue are pre-treated in a manner that they would be ready to react with the probes in the DNA-chip and bind to the appropriate partner probe in a gene-specific fashion.

In one shot, this method allows the screening of as many as 6000 genes. In the first set of experiments, Weindruch and coworkers compared the gene expression profile of healthy adult (5-month-old) mice and 30-month-old (old) mice by monitoring the messenger RNA levels of the 6347 of genes that they could survey with the DNA-microarray. Only about 60 genes were seen to increase in their expression with age. Thus the aging process is apparently

unlikely to be due to large, widespread alternations in gene expression. But of the 58 genes that increased in their activity with the age of the animal, a significant fraction were those that helped cope with stresses, the so called stress response system. These genes are induced to express (i.e., make their proteins or control other genes) when the system experiences oxidative stress, DNA damage, heat shock and the like. A second class of genes that are activated upon aging are the ones connected with injury or damage to the nerves.

These genes help in the repair of muscles, in re-innervating muscle fibers and in neuronal growth. On the flip side, the energy metabolism machinery is slowed down (or down-regulated as the jargon goes). The genes involved in protein turn over were also seen to be down-regulated. A consequence of this would be the accumulation of chemically damaged and modified proteins and enzymes that perform inefficiently; in the normal cells these are flushed out and replaced by the original functional molecules.

Next, they compared the gene expression profile of two groups of 30-months-old mice; one group was fed normally all along while the other group was put on a CR (76%) diet for the first 28 months of their lives. The results seen on CR mice were quite the opposite of what

was seen with aged mice. In CR mice, the genes responsible for protein synthesis and turnover are up-regulated. There is thus increased protein synthesis as well as turnover; damaged proteins are flushed out more efficiently.

Energy metabolism also increases, since the genes responsible for the production of glucose, fatty acid and nucleotides (the building blocks of DNA and RNA) are up-regulated. Side by side, there is down-

regulation of inducible detoxification and the DNA repair systems; since the damage is less and is not accumulated, it appears that the repair crew and the defence mechanisms are given some relaxation. CR seems to cause a metabolic shift towards increased biosynthesis and turnover. It is not clear yet as to what triggers this shift, but it might well be hormonal. Some believe that this could be an alteration in the insulin-signalling pathway.

*Courtesy : The Hindu.*



## MIND AND FOOD

N. KRISHNAMOORTI

I have a friend, a very fat person. His father was a halwa dealer. I used to think that this person must have been eating a lot of halwa every day. One day, out of curiosity, I asked him about it. He responded, "I do not eat halwa at all. I just sit in my halwa shop, look at the halwa heap and I become fat". Later my friend's father confirmed to me that his son eats very little sweet. This confirms the theory that mind apart from the body requires food and its needs could be fulfilled just by looking at food. My friend was absorbing food from the halwa just by looking at it.

Vinobaji, used to say that when he occupies a larger room he requires less food, and when he is confined to a smaller room the food intake has to be more. The body can absorb energy from ether.

The Seharia tribals of Madhya Pradesh require very little medicine to cure their infections. A local leader confided to me that the constant contact with earth for generations together has enabled the tribal children to absorb energy from the earth. Whatever the science behind it, there

appears to be no relation between their work output and the calories they consume!

The story is told of Tenali Rama, the court jester of Emperor Krishna Deva Raya. Once the jester told the emperor that he could make an animal lose weight even after feeding it properly. The emperor challenged him to prove his words.

Tenali Rama brought a healthy goat and fed it with gram and grass for a period of two weeks and the animal showed marked gain in weight. Then keeping the quantity of food a constant, Tenali Rama installed a caged tiger in front of the goat.



And lo! All the proved nutrition could not help the goat to retain its weight and the terror forced the goat to shed its weight!

## **A MULTI-PRONGED ATTACK ON EXCESSIVE CONSUMPTION**

**T**he intelligent, spiritually oriented, well meaning minority can be convinced that by shifting the locus of enjoyment and happiness from external object to the enjoyer himself, his dependence on them can be gradually reduced to nothing. In his case dependence upon external objects will be nominal, but his functional efficiency, health and happiness will not be affected adversely.

To the socially oriented, appeals of the ethics of proper sharing, among all members of the society, educating them on the long term adverse effects of despoiling nature and plundering its gifts will be effective.

To the money minded, simply balancing the long term effects of one's investments in renewable energy sources against his immediate needs can be taught in the language of the economist. In fact in Germany and in the U.S. many educated conscientious industrial leaders have started seeing the logic in conservation and environmental restraint. Man should learn to look upon

biological diversity, forests, culturally proved methods of production, fossil fuels, etc. as fixed capital assets, that can be depleted only at man's peril. No worthwhile financial expert will permit capital to be excerpted and spent on revenue account without rebuilding alternative capital assets of long term value.

Appealing to the moral, ethical and aesthetic values in man will pay certain dividends.

Laws should be enacted to protect the environment. Formal education, social education, developing models, exemplary behaviour, holding out the threat, all should combine to bring home to erring man the grave importance of ecological safety.

Improved technology can certainly reduce costs, cut wastes, improve functional efficiency, make use of lower grades of raw materials, recycle waste, add to the employment opportunities, cut transmission losses and costs.

Certain wasteful, dangerous technologies have to be totally abandoned.

The concept of appropriate technology has somehow come to acquire a negative connotation. People

tend to think that appropriate technology is technology compromised for social compulsions. It is not so. It simply says that a perfected efficient *charkha* is a better science than an inefficient nuclear power plant.



# **FACING THE PROSPECT OF FOOD SCARCITY**

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**LESTER R. BROWN**

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## **1. INTRODUCTION**

During the 1990s the growth in world grain production has slowed dramatically while demand has continued to climb driven by the addition of nearly 90 million people a year and an unprecedented rise in affluence in Asia led by China. The gap has been partly filled in recent years by drawing down carryover stocks, the amount left in the world's grain bins at the start of each new harvest. By 1996, the carryover stocks had fallen to 50 days of consumption, the lowest level on record. Growth of oceanic fish catch came to a halt in 1989. There is little cropland to bring under the plough. The scarcity of fresh water for irrigation is growing. The existing varieties of grain are not able to use more fertilizer than is already being applied. Farmers already troubled by vagaries of weather are now needed by the problem of climate change. Crop-withering heat waves shrink harvest. This happened in US, Canada, Europe and Russia. When atmospheric carbondioxide levels continue to build, temperatures rise.

Increasing demand is another problem. Asia, home to more than half the world's people (population : 3.1 billion), is finding its people enjoying new levels of affluence and moving up the food chain, eating more pork, poultry, meat, and eggs and drinking more beer all of which are grain-intensive products.

## **2. FOOD SECURITY TRENDS**

All the basic indicators of food security - 1) grain production per person 2) sea food catch per person 3) carryover stocks of grain 4) sea food prices and 5) grain prices signal a tightening situation during the 90's.

## **3. LAND AND WATER SCARCITY**

As the world's population has reached 6 billion and continues to expand, both the area of cropland and the amount of fresh water per person are shrinking, threatening to drop below the level needed to provide minimal levels of food security. Farmers have been using ingenious methods to expand the area used to produce crops.

These included irrigation, terracing, drainage, fallowing and even, for the Dutch, reclaiming land from the sea. Terracing allowed farmers cultivate steeply sloping land on a sustainable basis, quite literally enabling them to farm the mountains as well as the plains. Drainage of wet lands opened fertile bottom lands for cultivation. Alternate-year fallowing to accumulate moisture helped farmers extend cropping into semi-arid regions. By mid-century frontiers of agricultural settlement had largely disappeared, contributing to a sudden slow down in the growth in area planted to grain, the source of half of human caloric intake consumed directly and a substantial share of the remainder consumed indirectly in the form of meat, milk and eggs. Between 1950 and 1981, the grain area increased from 587 million hectares to 732 million hectares. But part of the expansion was on land that was subject to severe soil erosion by wind or water. Cropland is being lost because of soil erosion, industrialisation, paving roads, etc. in addition to the conversion of grain land to non-farm uses. Substantial areas are converted to other crops such as oil seeds, fruits, and vegetables, as industrialisation progresses and incomes rise.

In addition to land scarcity, farmers are now facing water scarcity. Rivers are drying up. Aquifers are overdrained, industries take away water from agriculture

and pollute water bodies. From 1950 to 1979 irrigation expanded faster than population increasing the irrigated area and the food production per person but since 1979 the growth in irrigation has fallen behind that of population. This trend continues. Monsoons waver. Temperatures soar. Water tables fall. Rivers dry up. The farmers are forced to use more and more fertilizers to keep up production.

#### **4. THE FERTILIZER FACTOR**

In the middle of the century when the scope for expansion of agricultural land disappeared, the use of fertilizer emerged as the key to raising the land productivity and thus to expanding the world's food supply. From 1950 to 1989 fertilizers ruled as a key global economic indicator. Fertilizer use went up from 14 million tonnes in 1950 to 146 million tonnes in 1989. All agricultural technology was focused towards capacity of a crop to use more fertilizer and to produce more grain. But in 1990, crops could take no more fertilizer as an enhancer of grain output.

#### **5. THE CARRYING CAPACITY QUESTION**

There is an urgent need to reassess the earth's population-carrying capacity. Earth's 100 million tonnes fish catch

shared by 5 billion people would provide 20 kilograms of sea food per person a year. The same catch shared by 10 billion people will work out to 10 kgs per person. With the frontiers of agricultural settlement almost sealed, carrying capacity calculations for land based food production have become very simple. From 1950 to 1990 the grain yield from the farms of the world rose from 1.06 tonnes in 1950 to 2.54 tonnes in 1990 per hectare. This is a total gain of 140% or 2.3% a year. This enabled the world's farmers to feed a population that had more than doubled during these 40 years. After 1990, productivity slowed down. From 1990 to '96 food productivity went up by a paltry 3%, that is, half a percent a year. Compared to the 1.6% annual population growth during this period, this growth is very slow. The world has to tighten its belt. Every year the world population goes up by 90 million. The average American consumes 800 kgs of grain a year, bulk of it indirectly in the form of animal products. In contrast, the average Indian gets 200 kg. of grain a year, almost all of it consumed directly. The Mediterranean diet of 400 kg. of grain is the food of the healthiest people. If the farmers of the world can succeed in pushing the grain harvest up from 1.8 billion tons (1996) to 2 billion tons that would be enough grain to support 2.5 billion Americans or 10 billion Indians,

depending upon whether we improve diets or feed more people. If the diet is 400 kg per person a year, 5 billion people can be supported.

The fish catch and land productivity having stabilised are starting to put tremendous pressure on national, political leaders.

## **6. FOOD SECURITY**

Slowing growth in food production, steepening growth in demand and rising affluence exert stress on the food security of individual nations. Shrinking water supply, crops that have become unresponsive to fertilizers, unpredictable monsoons, and rising global temperature complete the scenario. To make matters worse, policy makers and the common people are yet to come out of the affluence - syndrome of the past. Excessive dependence on import is no answer.

## **7. CONCLUSION**

Until recently, the world had three reserves it could call on in the event of a poor harvest: cropland idled under farm programs; surplus stocks of grain in storage; and the one-third to the world grain harvest that is fed to livestock, poultry, and fish. As of early 1997, two of



these reserves - the idled cropland and the surplus stocks – have largely disappeared. The only remaining reserve that can be



writing on the wall /

tapped in a world food emergency is the grain used as feed. This is much more difficult to draw on.

The food scarcity is likely to emerge as the defining issue of the era now beginning, much as ideological conflict was the defining issue of the historical era that recently ended. National political leaders everywhere will be thoroughly challenged by the new demands placed on them by the prospect of growing food scarcity. Ensuring the food security of the next generation requires fundamental changes in population policy, energy policy, land use policy, water use policy, and indeed, in the very definition of national security itself. Whether or not political leaders can respond quickly enough to avoid widespread political instability remains to be seen.

*Source : State of the World 1997, W.W. Norton & Co., New York.*



## BIOTECHNOLOGY AND FOOD SECURITY

Dr. M.S. SWAMINATHAN

**T**here has been considerable debate in recent years on the potential impact of new biotechnologies on agriculture. According to Ellen Messer and Peter Heywood (*Trying Technology: neither sure nor soon*; *Food Policy*, 15, 336-345, 1990), the impact of biotechnology in overcoming hunger may have to await the next millennium. Since this view is not widely shared, a few issues relating to research and extension in the field of biotechnology are dealt with at some length.

The term biotechnology is currently being used to connote a wide variety of biological manipulations such as cell and tissue culture, embryo transplantation, transfer of DNA material across sexual barriers, vaccine production, bioremediation, microbiological enrichment of cellulosic material, fermentation and various forms of biomass utilisation. There are immediate opportunities for the multiplication of superior clones of fruit and forest tree species, as well as plantation crops like cardamom and oil palm through tissue culture methods. Enhancing biomass

production and its conversion into energy are important applications.

The significance of biotechnology for a better biofuture of the Third World can be illustrated by taking the example of Asian agriculture. Asia has over 50 per cent of the global population, over 70 per cent of the world's farming families, but only 25 per cent of the world's arable land. At the beginning of the 21st century, the per capita land availability will be 0.1 ha in China and 0.14 ha in India. The average Asian population growth rate is 1.86 per cent.

The only pathway open to countries like China and India for feeding their growing human populations is continuous improvement in yield. This involves research which can further raise the yield ceiling. China has gone into the large-scale exploitation of hybrids in rice for this purpose. The tools of biotechnology can help in raising the productivity of major crops through an increase in total dry matter production which can then be partitioned in a way favourable to the economic part.

## AQUACULTURE

A market research report entitled "Biological Products for Aquaculture: A Worldwide Market Study on Vaccines, Therapeutics, Diagnostics, Hormones and Genetic Manipulations" published in 1990 by the Technology Management Group, New Haven, U.S.A., suggest that as aquaculture farms increase their production per unit space, effective disease and stress control will assume greater importance. The markets for vaccines, diagnostics, hormones and new feeds will increase. It is anticipated that by the year 2000, 25 per cent of worldwide seafood consumption is likely to be produced by aquaculture. Vaccines are seen as a growth area, since vaccines are still needed for many major diseases. In Scandinavia and parts of the U.S.A., nearly all trout and salmon, produced by aquaculture, were vaccinated in 1989 as compared to 5 per cent in 1984.

Many companies are developing aquaculture therapeutics to meet the growing demand. It is estimated that over 50 per cent of the total global production of fish, shellfish and molluscs is lost to disease. Breeding programmes and genetic engineering have led to the production of new "boneless" breeds of trout that have a better feed conversion rate, and salmon which possess an antifreeze gene to enable them to survive in colder waters. Further

research in fish breeding is expected to focus on growth acceleration, sex identification and determination, flesh quality, disease resistance, sea water adaptation, and the ability to utilise specific dietary components. Thus, biotechnological research is opening new windows of opportunity both in terrestrial and aquatic farming systems.

Biotechnology can be useful in integrating brain and brawn in rural professions. For example, Kerala state in India is developing the district of Ernakulam as a Biotechnology District, for taking advantage of its rich educated human resource, particularly educated women, who often tend to be employed in unskilled jobs. The programme will include extensive



**FOOD.** At present, 20% of world's population has insufficient to eat, and the proportion is increasing. One child in three is malnourished. By the year 2000, it is estimated that 64 countries will be unable to meet their food needs. Cropland worldwide has decreased by 7% since 1981. 50% of the developing countries have experienced falling per capita staple food production over the past 10 years.

**- Alan Herbert.**

tissue culture propagation of forest tree species, banana, cardamom and ornamental and medical plants, genetic improvement of cattle and poultry, and the establishment of biomass refineries.

The cause of educated unemployment is often not the lack of employment opportunities *per se*, but the paucity of employables skills in educated youth. The prevailing mismatch between the skills needed for the sustainable conversion of natural endowments into economic wealth could be ended through a carefully planned learning revolution. Centres of training in biotechnology, based on the method of learning by doing, can play an important role in ending this mismatch.

A reference needs to be made to a few of the major concerns of Third World scientists and political leaders relating to current global trends in the objectives and organisation of biotechnological research. First, the farm sector is a major export-earning enterprise for Third World countries. Therefore, there is genuine concern about the potential adverse impact of genetic engineering research directed at finding substitutes for natural products. Some examples are: high-fructose corn sweetener as a substitute for sugarcane sugar, and substitutes for vanilla, cocoa and diosgenin extracted from *Dioscorea* species.

A second major concern relates to the safety aspects of genetic engineering research. Will tests be done in the Third World which are not permitted in the industrialised countries? Will “super weeds” arise from research aimed at the development of pesticide and herbicide resistant crop varieties? Will the ecological ground rules underpinning the field testing of transgenic material be the same everywhere?

Third, the nutritive quality and food safety issues relating to genetically engineered strains and growth-promoting agents like bovine growth hormones need careful study, using criteria more relevant to conditions where undernutrition and malnutrition are widespread. Will crop varieties with multiple resistance to pests contain toxins which will ultimately affect the health of the human beings or animals consuming their economic parts? What kinds of safety evaluation procedures are needed for food ingredients produced by micro-organisms, single chemicals and simple chemical procedures and whole foods and other complex mixtures?

Fourthly, will the biotechnology revolution help resource poor farmers increase productivity largely with the help of farm grown inputs? How can we design mutually reinforcing packages of technology, services and public policies

which can ensure that all rural people - rich or poor, land owners or landless labour families-can derive economic and social benefit from new biotechnologies? Is it possible to design a pro-small farmer and pro-poor biotechnology programme?

Fifthly, what will be the impact of the extension of intellectual property rights to individual genes and genotypes on the availability of such improved material to developing countries and resource-poor farm families? Also, will intellectual property rights be exclusively reserved for rewarding formal innovation, although the informal innovation system has played and is playing a key role in the identification and conservation of plant and animal genetic resources? What are the rights of the farm families who have conserved and selected genetic diversity, in contrast to the rights of the breeders who have used them to produce novel genetic combinations? How can the concept of genetic diversity as a common human heritage be promoted, if only a few can derive economic benefit from such diversity?

Sixthly, will priorities in biotechnology research be solely market-driven or will they also taken into consideration the larger interest and the long-term well-being of humankind, whether rich or poor? In other words, will orphans remain orphans in the choice of research priorities and investment decisions? For example, rice is the staple

of nearly half the human population most of whom live in Asia. Yet, the application of biotechnological know-how to solve some of the important problems in rice production would not have received the financial and scientific support they needed but for the decision of the Rockefeller Foundation to make a major long-term investment in this area. Human diseases like leprosy also illustrate this point.

Finally, there are environmentalists who believe that each technological fix to an ecological problem will ultimately generate new levels of ecological catastrophe. They therefore caution against venturing into unknown territories. This is particularly important in medical biotechnology, where issues of ethics frequently arise.

The above concerns can be met only by a proactive analysis of the potential beneficial and adverse impacts of biotechnological research, not only from the economic angle but also from the ecological, equity and ethical perspectives. Social scientists and ecologists should be involved in project design teams right from the beginning and should not just come at the end to make a post-mortem analysis. For biotechnology to lead to a better future for humankind, we need a systems approach, keeping in mind Albert Einstein's exhortation that human well-being should be the ultimate objective of all scientific endeavour.

## **BIODIVERSITY AND BIOFUTURE**

Our biological future depends on our ability to conserve and utilise the rich genetic diversity occurring in living organisms on our planet. The extent of ignorance on the number of species existing on earth came out clearly at a Conference on the Ecological Foundations of Sustainable Agriculture organised by the C.A.B. International in London in July 1990. Some experts felt that more than 50 million species may be occurring, particularly when we take into account invertebrates and micro-organisms, while less than 2 million have been described so far. This underlines the importance of training more biosystematists, particularly in relation to invertebrates and micro-organisms.

Unfortunately, there is much controversy on methods of saving and sharing the global biological wealth. Discussions on this topic are in progress in various international fora such as FAO and UNEP. The Keystone International Dialogue Series on Plant Genetic Resources has tried to throw light on methods of resolving opposing viewpoints. Terms such as "Farmers' Rights" and "Breeders' Rights" are freely used to indicate the importance of according recognition to the informal innovation system in conjunction

with the rights already accorded to plant breeders in the 20 developed nations which have so far adhered to the rules of the International Union for the Protection of New Varieties of Plants (IUPOV). The ongoing discussions at the General Agreement on Tariffs and Trade (GATT) on Trade Related Intellectual Property Rights (TRIP) are also important in the context of North-South relationships in germplasm conservation and exchange. Fourteen developing nations have proposed to the negotiating group on TRIP at the Uruguay Round of multilateral trade negotiations that plant or animal varieties or essentially biological processes for the production of plants or animals should not be subjected to patent protection.

Farmers and breeders are allies in the common task of advancing biological productivity. Therefore, their rights should be presented not as mutually antagonistic but as mutually reinforcing ones. Such a goal can be achieved if UPOV ultimately evolves into an International Union for the Protection of Breeders' and Farmers' Rights, with its membership including all countries - industrialised and developing.

***Source : Biodiversity Implications for Global Food Security, Edited by M.S. Swaminathan & S. Jana, Macmillan India Ltd., Madras, 1992.***

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## PRODUCING PLENTY TO SHARE

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JITENDRA BAJAJ & M.D. SRINIVAS

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There is clear record of generous sharing of food in India, that could have been practised only in a polity that produced in plenty. British records of the present Chengalpattu district of Tamil Nadu offer a picture of abundant agricultural prosperity. Some 1,00,000 hectares of land were estimated to have produced 2,50,000 tonnes of paddy and other grains for about 46,000 households in the survey period 1767 to 1774. The total produce of the land thus amounted to about 5.5 tonnes of foodgrains per household per year which represents a very high level of prosperity, not merely by the Indian standards of today which is low but also by the standards of the most prosperous countries of the world.

Average productivity of cultivated lands in that region at that period was, however not very high. The overall average of about 2.5 tonnes per hectare is indeed somewhat higher than the average productivity in India today, which remains below 2 tonnes per hectare. But the lands in India are known to have produced a great abundance. Inscriptions

from the Thanjavur region in Tamil Nadu from 900-1200 AD speak of lands paying revenue of the order that indicates the production of 15 to 18 tonnes per hectare.

A few inscriptions record that lands in a village of South Arcot produced around 14.5 tonnes of paddy per hectare. Another inscription of 1325 from Ramanathapuram records a high production of 20 tonnes per hectare (of paddy).

Similarly high levels of productivity were reported by early British observers from many parts of the country. An European observer in 1803 recorded a production of 7.5 tonnes (of foodgrains) per hectare in the region around Allahabad. Another Britisher reported yields of 13.00 tonnes per hectare in Coimbatore in 1807.

In Chengalpattu the yield varied from 2.5 tonnes to 9 tonnes of paddy per hectare.

Thus did India follow the discipline of producing aplenty (and of sharing

aplenty), sustained the discipline of producing and sharing aplenty as per the Vedic injunctions.

(Extracts from *Annam Bahu Kurvita, Centre for Policy Studies, Chennai, 1996*).

## FOOD



**Old lamps for new**

The innumerable ecological niches in the sub-continent have led, over a period of 4,000 years, to practices which were selected for each micro-ecological region. Only a few of the special practices that prevailed about a hundred years ago, are mentioned here. Some still exist but many have been changed or destroyed. Such knowledge, again, needs to be preserved *in situ*.

## VARIETIES

India's rices possess wide diversity in their characters. They vary in duration from 60 to over 200 days and can grow in varied elevations, ranging from a metre below sea-level to an altitude of 2000 m. At one extreme are the deep water rices, growing in 6 to 15 m of water, and at the other rice is grown with an annual rainfall or barely 500 mm.

R S Richharia collected 20,000 varieties within 10% of the Chattisgarh area of the Chattisgarh area of Madhya Pradesh alone,

with 200,000 varieties estimated in the whole country. They have grain lengths from 3.5 to 14 mm and widths from 2 to 3 mm. There are red rices, fine and scented rices, and glutinous rices. There are varieties with purple leaves. Some peculiar varieties have 2 or even 3 grains in one husk.

Varieties were and are still chosen for needs, definitely not for maximum yields. They were chosen for their ability to withstand droughts or floods, resistance to pests, susceptibility to disease, toleration of salinity, time of maturity, height of the plant, non-lodging and non-shedding characteristics, size of the grains, colour, taste and aroma, time for cooking, keeping qualities, nutritional values and many other characteristics. In addition, some gave yields of more than 3700 kg/ha, putting them in today's high-yielding category.

In some areas, rice that gets sticky after cooking is preferred to that which does not, while in others, the reverse is the case. Rices with thin long grains fetch more in the market than those with thick, coarse grains. Further, most rices need to be stored for a few months before they lose their stickiness but some can be consumed immediately after harvest.



## **AGRICULTURE - LAND, FERTILIZER, PESTICIDE, LIVESTOCK, FORESTS**

**Ostrich :** But for the Green Revolution and scientific agriculture, man would have lost the race for survival.

**Parrot :**  
Specialisation,  
biotechnology, new  
seeds and better  
fertilizer will see  
humanity through his  
food problem.



**Swan :** There are social historians who say man made his greatest blunder when he discovered agriculture and started countering Nature's ways of managing human population. Whatever it is, agriculture based on over irrigation, over fertilizing and hybrid seeds have produced water pollution, use of chemical pesticides, endangering the fauna and flora.

**Parrot :** We can bring more land under the plough. We can irrigate more lands and produce more food grains.

**Swan :** Scope for more land under

the plough is very meagre. Already the world's forests have shrunk far below the required 33% of land area, essential for monsoon predictability, assuring quantity of rainfall, controlling soil erosion and maintaining biodiversity. Over exploitation of groundwater has led to great fall of water table levels. Science has only temporarily solved man's problems, leaving the larger problems, and long term dangers unresolved.

**Parrot :** At least fertilizers should ease the problem.

**Swan :** The capacity of crop plants to convert fertilizers into food grain has already been maximized. Addition of fertilizers can no more reflect increase in grain yields. The Green Revolution already has increased the production of grains. Further chemical fertilizers pollute water bodies, make the plants disease-prone, and have paved the way for greater pesticide applications. Pesticide residues in grains, vegetables and cattle feed have already reached proportions that are injurious to human beings and animals. Man has to learn how to use composts, manures,

vermicomposts, biofertilizers, biopesticides, etc.

**Parrot :** Why should we have so many forests? They make me feel “jungle”.



*But for the green revolution and scientific agriculture, man would have lost the race for survival*

**Swan:** Forests, apart from controlling pollution and safeguarding monsoon predictability and soil erosion, preserve biodiversity and protect wild life.

**Ostrich :** How do livestock fit into the agriculture industry?

**Swan :** Agriculture is not an industry. It is an art and a way of life dealing with living beings. Livestocks, poultry, goats, sheep, pig and cattle farm are an integral part of the farm. Livestocks feed on agrowastes, bye-products and residues and produce manures for the farm. Cattle manure increases the humus content of the soil, increasing its porosity and the capacity for moisture retention. It is the so-called modern agriculture that has divorced the

livestock from the farm. An integrated livestock-farm is a closed circle. Animal wastes form farmyard manure. Farm wastes are gobbled up by the livestock. “Modern” agriculture has flattened the closed circle. It feeds chemical fertilizers brought from outside into the land; at the exit point are pollutions and agro wastes. Traditional integrated agriculture closes the loop and eliminates chemical fertilizers and pesticides and saves the farmer the botheration of chemical pollution and waste disposal.

**Parrot :** Mechanisation of agriculture should lead to increased food production.

**Swan :** The exact opposite is true. The sustainable agriculture calls for consistent reduction of external points such as fossil fuel, chemical fertilizers, and pesticides, hybrid seeds, etc. all of which take away the farmer’s self-reliance and cut down his profit. A poor country like India cannot afford to waste the enormous energy of its draught animals and waste the foreign exchange on dwindling petrol/diesel for tractors.

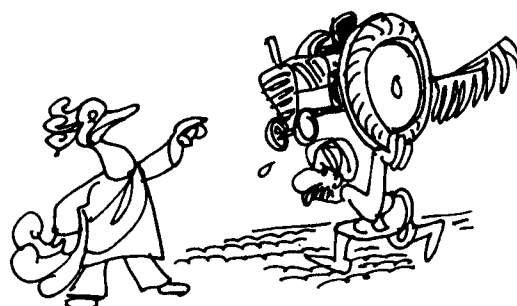
*Agriculture is not an industry. It is an art and a way of life dealing with living beings.*



## MODERNIZATION OF AGRICULTURE

Dr. M.S. SWAMINATHAN

In the past century, agriculture has undergone great changes all over the world. The guiding themes were 1) increased food production, 2) save the environment. There have been significant increase in the quantity of food produced and land conserved. This is the effect of modernization.



Modern technology is dumped on the farmer through coercion and enforcement.

1. What are the drawbacks of Modernization?
  - a) Technologies and practices are assumed to be universally rated and workable.
  - b) They are held to exist independent of the social context whereas they are not.
  - c) The farmers are blamed and the technology is held unblameable when they don't adopt the 'alien' technology.
  - d) The modern technology is dumped on the farmer through coercion and enforcement.
- 2) Agricultural modernization processes have produced.
  - a) The industrialized types, b) green revolution types c) complex and diverse types.

(a) and (b) have led to increased productivity. (c) has been forgotten though it supports nearly 200 crores of people. Here the poor farmers become poorer. The rich farmers are coerced to buy the modern agro technological packages.
- 3) Environmental conservation has been pursued with the help of inappropriate technologies, developed in a

particular historical context and transferred to an alien receiving environment. Efforts to (i) conserve soil (ii) water (iii) establish protected areas (iv) manage grazing lands have been (a) highly costly, b) ineffective, c) alternate local people and (d) methods used to bring about changes are not voluntary. The farmers have been paid, coerced, and enforced to buy alien technologies and then abandon them.

4) The problem of packaged technologies.

a) farmers do not want to take risks, b) ideal conditions of the lab don't exist in the field, c) package can only be taken in full; half way measures do not pay, (d) the initial attraction fades away with time, (e) where adaptation is possible farmers succeed, (f) problems of sustain-ability arise.

5) The question of costs.

The new processes are costly for farmers and countries. Low cost technologies are needed, that can touch the lives of 200 crores of people. The modernist strategies are beyond the reach of most of the poor countries. Rural indebtedness, agricultural exports, fall in international prices of agro products, low yield,

high cost of soil, water and conservation packages input-subsidy, cost of dams, fertilizer factories and other capital assets combine to keep modern methods of agriculture beyond the reach of the poor people and poor countries.

**WHY DOES THE POOR FARMER REJECT THE “MODERN METHODS OF AGRICULTURE?”**

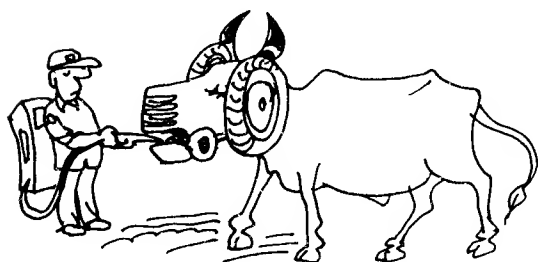
(1) Absence of a problem, (2) inappropriate innovation. The cure the researcher suggests has nothing to do with the farmer's problem, (3) General unawareness, (4) incorrect identification of adoption domains, (5) Local practices are better than the 'Modern' methods, (6) The Modern methods generate new problems, viz., weeds, pests, (7) High cost, (8) Poor extension, (9) Insecure land tenure—tenant farmers will not plant trees or build terraces on lands not their own, (10) Inappropriate incentives.

**MODERNIZATION OF AGRICULTURE; THE SOCIAL AND ENVIRONMENTAL COSTS**

1) The drive for agricultural efficiency has cut agricultural job opportunities in industrialised countries. External inputs of machines, fossil fuels,

pesticides, and fertilizers have displaced workers in Green Revolution Lands.

- 2) Pushing people to migrate for work  
Modernization of Agriculture has put rural cultures under pressure.
- 3) Local institutions such as family, community, credit systems culture have suffered, and withered away.
- 4) Environmental and health impacts of modernization of agriculture have increased in recent years. The cost of environmental damage are growing, all segments of national economies have to bear the burden of these costs. Fossil fuel is consumed more and more in



Fossil fuel is consumed more and more in modernisation of agriculture resulting in global warming.

- modernization of agriculture resulting in global warming.
- 5) Pesticides have caused problems by inducing resistance in pests, damaging the health of the farmers, farm workers and consumers. The

hazards are greater in the third world. Three to 25 million agricultural workers are poisoned each year. Nearly 20,000 die every year on this account alone. National economies and affected individuals suffer cruelly.

- 6) The problem of soil erosion continues to dog farmers, eating away 3-14% of their gross agricultural product/income in a year. Though indigenous systems of soil conservation and water saving are widespread, well adopted to local conditions, persist for long periods, and are capable of supporting dense populations, soil erosion is spreading. Soil erosion reduces the biological productivity of the soil, and the capacity to sustain future productivity.

- 7) Where local people are not involved in planning and implementation, soil conservation programmes fail, and terracing and bunding disappear. Poor terracing results in worse erosion. Design, construction and maintenance should take in local people. Otherwise the entire conservation programme is in danger of rejection by local people.

- 8) Bio diversity has fallen under modern agriculture. Traditional farmers and

low input agro systems have favoured diversity on the farm. Single species and varieties occupying fields is a modern phenomenon. Modern varieties and breeds displace traditional varieties and breeds. During 20<sup>th</sup> century alone 75% of the genetic diversity of agricultural crops has been lost. Only about 150 plant species are now cultivated of which 3 supply almost 60% of the calories derived from plants.

- 9) Modernization of agriculture has resulted in loss of jobs in all countries, further shift of economic opportunities from women towards men increasing specialization of livelihoods, concentration of land in fewer wealthier villagers and money in fewer urban investors, the increasing gap between the rich and the poor, politicisation of village institutions by the state are the other changes that have taken place in the 20<sup>th</sup> century. Modernization of agriculture may not be the sole cause of these changes, but its contribution towards the change has been substantial.

In the tropics alone the land devoted to National parks and protected areas has grown from 58 million hectares to 174 million hectares in the past 50

years. (More and more land is becoming unsafe for wildlife).

### **Modernization in the Urban Environment**

alienation conflict  
increased individualism  
breakdown of communities

### **Agricultural Modernization in Rural Environment**

jobs lost  
Environment polluted  
Communities broken up  
People's health damaged  
All sectors of economy affected.

### **Modernization of Agriculture**

- 1) Cuts the number of jobs, people engaged
- 2) External inputs of machines, fossil fuels, pesticides, fertilizers increase in quantity
- 3) Workers replaced
- 4) Rural culture put under pressure
- 5) People migrate in search of work
- 6) Local institutions weakened
- 7) farms simplified
- 8) What was once a resource has now turned a waste to be disposed off.
- 9) Some external inputs contaminate the environment

- 
- |   |  |
|---|--|
| 10) Water, soil, atmosphere contaminated.<br>11) Agriculture has become fossil fuel intensive.<br>12) Agriculture too has begun contributing to Global Warming.<br>13) Overuse of pesticides leading to pest resistance — pest resurgences increased application of pesticides. | pesticide sprinkling, irrigation fertilizing.<br>5) Incomplete absorption of fertilizer, pesticide, resulting in contamination of Environment.<br>6) 30 to 80% of Nitrogen applied is wasted and goes to contaminate water food and fodder.<br>7) Significant amount of pesticides left unabsorbed.<br>8) Water wasted, leading to ground water depletion water logging, and salinity.<br>9) Costs go up.<br>10) Drinking water system contaminated. |
|---|--|

### **Advantages of a Mixed Farm**

1) A closed system, 2) Generates few external impacts, 3) crop residues fed to livestock, 4) crop residue incorporated into the soil, 5) Manure returned to soil in quantities that can be absorbed and utilized, 6) legumes fix Nitrogen, 7) Trees and hedges bind the soil, 8) Trees and Hedges provide fodder, fuelwood and habitats for predators of pests. Components of the farm are complementary products and by products being similar. Both flow one component to another, the household deciding when to draw off a product for marketing.

### **Environmental Pollution and Contamination By Agriculture**

- |  |   |
|--|---|
| 1) In the last 50 years many integrated farms have broken down.<br>2) Farms specialised.<br>3) Crop and livestock separated.<br>4) Operations specialized for e.g. | (11) Pollutants harm farm and local natural resources.<br>a) Pesticides damage predator populations/wildlife and induce resistance in target pests. |
|--|---|

- b) Nitrates, ammonia disrupt wild plant communities.
  - c) Metal contents of soils go up.
  - d) Pathogens in wastes harm human beings/animals.
  - e) Atmosphere contaminated by Ammonia leading to acid rain.
  - f) Nitrous trioxide corrodes the ozone layer.
  - g) Methane cause global warming.
- 12) Consumer affected by excess pesticides, nitrates, antibiotics especially in the third world. Cereals, fish, milk are contaminated.
- 13) Food sold in local market carries recently sprayed pesticides, especially leafy vegetables, cabbage etc.

### **Energy Consumption increases due to Modernization of Agriculture**

1. Modernization of Agriculture substitutes external energy (fossil fuel) for locally available energy.
2. Energy intensive N fertilizers, pumped irrigation mechanical power are applied in modernization of agriculture.

### **SALINITY**

A large number of causative factors are reported to be responsible for salinity/alkalinity and water-logging. The important reasons for the deteriorating soil environment are:

- a) Higher seepage losses;
- b) Poor operation and maintenance of canal net works;
- c) Introduction of canal irrigation in marginal lands;
- d) Mismanagement of canal irrigation.
- e) High subsidy on canal irrigation;
- f) Higher acreage allocation in favour of rice and sugarcane; and,
- g) Poor groundwater quality.



**Listen**

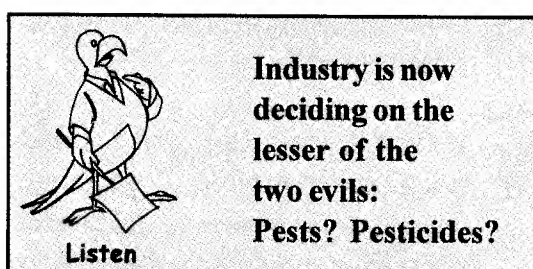
Some other location-specific reasons observed are poor drainage porosity of soil, lack of drainage outlet, presence of shallow hard pan below soil surface, saline groundwater, etc.

At the regional-level, the consequences are:

- a) Displacement of labour from agriculture;
- b) Widening income disparities, and,
- c) Declining sustainability of secondary and tertiary sectors.



- They total 90% of agricultural energy input in the third world.
- 3) Mechanization forces increased foreign exchange expenditure on fuel, oil, engine, spares.
  - 4) In India 10-20% increase in yields following mechanization costs extra 43 to 260% in energy consumption.
  - 5) Larger the farm more the unit energy spent. In Punjab, farms of size 14-25 hectare spend 3 times more energy per hectare as farms smaller than 6 hectare.
  - 6) In industrialised countries human labour is costlier than fuel energy. In the third world countries the reverse is true.
  - 7) The total effect is global warming.
  - 8) Centralized farming increases transport costs/transport energy spent.
    - a) In US food travels an average of 3000 km from farm to place.
    - b) In Britain 80% of the energy spent on food is spent in milling, baking, transporting and retailing food.



### **Modernization of Agriculture in India Output-energy Consumption Relation :**

In India when the mechanization of bullock energy farm to power tiller use came about 8% increase in output required 43% increase in energy input.

For tractor, 13% increase in yield cost 74% extra energy .

For wheat tractor 6% increase in yield cost 266% extra energy.

### **Pesticide induced Pest resistance and Resurgences :**

1. Pesticides can cause resurgences by killing off natural enemies that control pests.
2. Pesticides can create new pests by killing natural enemies of species which were hitherto not pests.
3. Pesticides can induce resistance in pests.

Insecticide applications disrupt natural control survival increases by more than ten times, and compound interest expansion then leads to hundreds of times higher densities within the duration of one rice crop. Trying to control such a

population outbreak with insecticides is like pouring kerosene on a house fire.

### **Pesticides and Human Health Impacts :**

Miscarriages, cancer, lymphoma, poisoning, infertility.

### **Loss of biodiversity because of modernization of agriculture**

- 1) A farmer prefers multi-cropping, inter-cropping, mixed cropping.
- 2) Farmers do not standardise their practices. They a) maintain diversity;



Farmers maintain diversity in their practices, develop a variety of strategies and spread risk.

- b) develop a variety of strategies; c) spread risk.
- 3) Mixed cropping give various outputs, chances of coping with the environment increases.

- 4) Mixed crops less variable in time and space, combined yields are greater, light, water and nutrients are used more efficiently.
- 5) Inter cropping reduces weed problems, influence labour requirements, returns to labour more.
- 6) Inter cropping reduces erosion, run off greater ground covered.
- 7) Less pests, less weeds in mixed cropping.
- 8) Farmers use varying strategies for combinations of landscape, soil type, hydrology flood / drought risk.

In Indonesia 42 combinations are cultivated.

Uncertain seasons use 25 combinations.

Taller and shorter crops combine well. Root systems go to different systems and thus use nutrients from different depths of the soil.

- 9) In Burma (Myanmar) rainfed uplands use 52 varieties of rice. Each farmer does not try to maximise yield nor do they have one preferred variety.

Sometimes they grow six varieties with a range of different taste, colour, pest resistance, growth pattern, duration, flood/drought tolerance, milling recovery and market price qualities.

- 10) With the introduction of modern varieties and breeds of crops, 75% of the genetic diversity of agricultural crops has been lost. About 150 varieties of plant species are now cultivated of which 3 supply 60% of calories derived from plants.
- 11) In India once 30,000 varieties of rice were grown. But now 10 varieties cover 75% of the whole rice area. In the US 65 types of vegetables lose 80-100% of the varieties of each since the turn of the 20<sup>th</sup> century. Of the 8207 varieties listed in 1903, only 607 are stored in seed forms. The greater the uniformity the greater the risk and danger of pest, risk and disease attack.
- 12) Mono cropping is promoted through incentives and laws.
- 13) Loss of genetic diversity leads to loss of future opportunity to raise adaptable crops, and livestock. They may withstand diseases, and pests with the help of breeding

resistant varieties. For example one rice variety from India has been central to efforts to cope with a devastating virus. During the 1970s grassy-stunt virus devastated rice from India to Indonesia. A four year research involving 17000 varieties of rice helped locating a disease resistant variety. One population of the wild species growing near Gonda in U.P. was found helpful. Today resistant rice-hybrids containing the wild Indian gene are grown across some 110,000 km<sup>2</sup> of Asian Rice fields. Genetic erosion, the reduction of diversity within a species is a global threat to agriculture.

- 14) The value of wild diversity for direct use and for upgradation through breeding is inestimable. For the common people wild varieties supply a large quantity of food, fuel medicine and fodder. These varieties perform well under low-input conditions. Some yield well. Others raise good amount of straw-fodder. The wild varieties form the basic stock for research.
- 15) Farmers do not replace existing varieties of crops by a new variety. They add the new to the old adding to the variety.

## DECLINE OF VARIETY OF CROPS AND LIVESTOCK

| Sl. No. | Country         | Original varieties         | Presently available varieties | Area Cultivated by selected variety as a % of total of the |
|---------|-----------------|----------------------------|-------------------------------|--|
| 1.      | India           | 30,000 (Rice)              | 10                            | 75%  |
| 2.      | Philippines     | 3,500 (Rice)               | 3-5                           | Irrigated areas  |
| 3.      | Europe          | Domestic animals           | Half extinct                  | 770 in danger of disappearing by 2010                      |
| 4.      | France          | Golden apple               | 1 variety                     | 71 %   |
|         |                 | Bread wheat                | 2 varieties                   | 30%  |
|         |                 |                            | 10 varieties                  | 70%  |
|         |                 | 250 plant species for diet | Only 30-60 varieties          |  |
| 5.      | Greece          | 100% local wheat           | 5%                            |  |
| 6.      | The Netherlands | Potato                     | 1 variety                     | 80% of the land cultivated                                 |
|         |                 | Wheat                      | 3 varieties                   | 90%  |
|         |                 | Barley                     | 1 variety                     | 75%  |
| 7.      | U.K.            | Potato 100%                | 3 varieties                   | 68% of the land  |
|         |                 |                            | 4 varieties                   | 71% of the land  |
| 8.      | U.S.A.          | Apple                      | 15%                           |  |
|         |                 |                            | 85% lost                      |  |
|         |                 | Pear                       | 88% lost                      |  |
|         |                 | Garden pea                 | 95% lost                      |  |
|         |                 | Field maize                | 91% lost                      |  |
|         |                 | Tomato                     | 81% lost                      |  |
|         |                 | Sweet corn                 | 96% lost                      |  |
|         |                 | Rice                       | 4 varieties                   | 65% of land  |
|         |                 | Maize                      | 6 varieties                   | 71% of the land  |

### **What wild plants/livestock mean to mankind**

Household income, food, medicines, fodder, provenance for domestication, grass, fish, snakes, insects, mushrooms, fruits, vegetables, tree fruits in dry season catering to a large percentage of people all over the world except industrialised countries.

### **Modernization of agriculture and breakdown of rural communities**

1. Number of jobs for local people gone.
2. Standardization has reduced the range of management skills needed.
3. Many decisions have been taken out of the hands of local farmers and institutions.

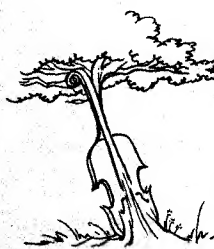
4. Women lose the race.
5. Increasing specialization of livelihoods.
6. Increasing concentration of land in rural weathering.
7. Increasing concentration of wealth in the hands of urban investors.
8. Growing gap between the rich and the poor.
9. Co-option of the village institutions for the purposes of the state.
10. Landscape homogenized; Farming systems simplified.
11. Diverse, integrated farms employing local people, have made way for specialised job for outsider.
12. Food processing jobs no more local; far away central factories do that work.
13. Lack of farm based rural employment has resulted in the decline of rural services, such as school, shop, doctors, public transport etc.
14. Rural poverty increases.
15. Percentage of older people in villages increasing.
16. Youth show less interest in labour intensive farming. Many farms have no successors.
17. Agricultural culture, thousands of years old, is vanishing in Japan.
18. Farm size increase, family farms vanishing, fewer people depend upon agricultural incomes.
19. Frustration, financial crisis, suicide on the increase among American farmers.
20. In Bali irrigation cooperatives 'Subaks' which control the religious, agricultural, cultural, ritualistic aspects have suffered.

**From : Regenerating Agriculture**

*Farmland manure formed an important component of traditional farming. Cowdung was collected not only from farms but also from roads, "waste" lands and other commons. Good quality cow manure typically contains about 0.6% nitrogen, 0.1% phosphorus and 0.5% potassium (fresh weight basis). It also has fungicides and perhaps other antibiotic components. In addition, the dung of*

*sheep, goats, poultry and other animals was used. Sheep and cattle folding was also common. It was estimated that 100 sheep were required to be folded for one month to give the equivalent of about 25 cartloads of FYM.*

**Music should  
continue**



## TENDING THE EARTH - AGRICULTURE

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WININ PEREIRA

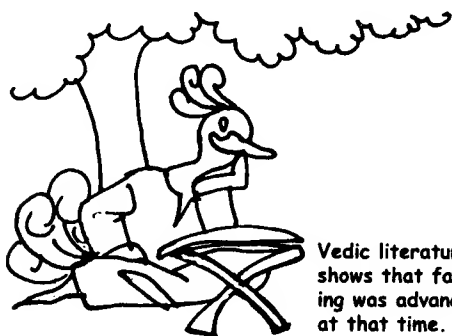
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**W**hile useful Indian concepts may or may not have been consciously applied, they were incorporated in the agricultural practices that were developed.



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Vedic literature shows that farming was advanced at that time, with a farmer possessing a fair knowledge of soil



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fertility, selection and treatment of seeds, seasons of sowing and harvesting, rotation, manuring, and the like. Cowdung was used as manure and two harvests a year sometimes gathered. Some of the crops mentioned in ancient literature cannot be identified and may

have gone out of cultivation, but most are still in use today.

With major population movements such as invasions of neighbouring areas not acceptable, and with no urban industry to promise them endless riches, the people had to rely on the available resources and their knowledge and skills to utilize them more efficiently. On the whole, the practices were designed to improve self-reliance and long-term security, even at the cost of immediate production.

There appeared to have been an understanding that, although the earth was large, they had to obtain most of their resources from within small closed ecosystems. If they harmed and destroyed this microworld, by overusing natural resources or polluting their environs, they would surely be harming and destroying themselves as well, for there was no other place to go, no cities with their false promise of industrial jobs, no new frontiers waiting to be conquered. At least, not without the application of force to displace other existing populations by unjust means.

They were, therefore, extremely careful not to foul their own nests.

With cultivable land limited, increasing production had to be obtained by devising complex systems, with practices that nurtured the earth, conserved and, perhaps, improved the natural resources of soil, water and genetic resources locally available. It required the preservation of the natural cycles of growth, decay and regrowth. Improvements came by restoring, enabling and speeding up such cycles which provided the nutrients for many creatures.

The resulting systems kept the crops healthy by providing the nutrients and an immediate environment that controlled pests and weeds. These were not developed as individual reductionist categories, but in a multiple use, and often synergistic manner. Such sophisticated systems must have taken hundreds of years to develop. They required intensive study of the farm and its surroundings, a knowledge of all the hundreds of possible crops that could be grown, with their permutations and combinations as intercrops and rotations, and what would now be termed management skills.

Traditional systems, strangely enough, reduced interference to a minimum by keeping the systems complex, as natural systems are. Inputs were limited to the use of renewable resources and that too very

sparingly. Self-reliance was maintained by not importing agricultural and industrial inputs and not exporting food and other agricultural outputs and village industrial goods.

Farmers obtained all their inputs from their own farmland or from the neighbouring commons. This required the recycling of the whole crop plant – grain, husk, stalk, leaves, roots. There can be no such thing as a crop waste in sustainable farming. The system had to include users of and uses for the whole crop: livestock to consume the straw and graze on the stubble, the animals in turn providing draught power, milk and meat. The animal manures, together with the husk and stalk composted or burned as fuel and the ashes returned to the field. The production of an even small quantity of unbiodegradable waste would be unsustainable, so “wastes” of village industries were recycled. The more self-reliant the farm became, the more complex it had to be, and the more wholesome and permanent became the system in which it was embedded.

Extra production was obtained only by developing technology which maximized the utility of the available resources: land area, water, varieties of species and crops which allowed infinite experimentation in rotations and intercropping. The crops selected had to have meshing farm

operations so as to maximize family labour efficiency.

The crops were selected according to the local soil, climate, and other environmental conditions, with no attempt to “level” the environment by bringing in distant fertilizers, irrigation, and other synthetic inputs.

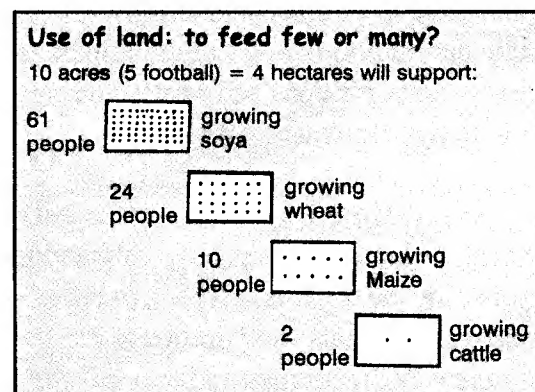
The development of this type of farming system required the simultaneous preservation of diverse ecological regions, such as pastures, forests, aquatic habitats and even “waste” lands. The commons provided essential farm nutrients to supplement what was recycled, fixed by legumes and brought up by deep-rooted plants in farms. Production was increased, not by clearing more forests for crop cultivation, but by using a little of the forest production to raise farm fertility. The forests also provided food and hundreds of other products directly, relieving agriculture of the burden of supplying them. Although the majority of such farms were subsistence farms, farmers did not need a high cash income because cultivated as well as wild plants provided them with their other non-food requirements.

Hedges and “waste” lands, provided habitats for insects, birds and other creatures, some of which were predators and parasites of pests. There was no need

to carry out botanical and zoological surveys. Diversity was maintained simply by allowing regions to “run wild”. There was no need to measure soil nutrients and rhizobia populations. Organic matter was returned to the soil, while keeping damage to the soil, flora and fauna, to a minimum.

Consumption was limited to that produced sustainably. Wants were not arbitrarily specified and then technology or bad farming practices used to attempt to obtain them. Individual selfishness and greed were kept down by the needs of the community and future generations. It required the deliberately sacrificing of immediate gains for the sake of long-term sustainability.

Vegetarianism is more sustainable than a food system based on a large quantity of meat products. Perhaps our ancients realized this or perhaps they were drawn to this by their realization of the oneness of all Nature, but it allowed a much bigger





population to be supported adequately. Cow worship could have arisen from a realization that bulls were necessary for traction and that they played an essential role in recycling crop “wastes” speedily. Livestock systems were limited to what was required for draught purpose and what could be supported by the farm by-products and sustainable grazing. But integration of livestock was essential for recycling as well as draught.

Much of the agricultural produce was processed in the village itself. There was

the husking, milling and grinding of cereals and pulses, and processing of sugar or other local crops. In every village there was a ghani (bullock-driven oil mill) for extracting oil from oilseeds, for edible as well as non-edible use. The residual oilcakes were immediately available for cattle feed and manures.

Sustainable agriculture also requires economic independence. It is precisely because it could not be commercialized that traditional agricultural practices were not exploitable.

#### **MIXED CROPPING HAS BEEN SHOWN TO HAVE MANY ADVANTAGES INCLUDING**

- ◆ different rooting systems exploit different levels in the soil profile for moisture and nutrients;
- ◆ one crop may provide a favourable micro-climate for another;
- ◆ nitrogen-fixing plants fertilise non-nitrogen fixing plants;
- ◆ crops which are scattered among others are less vulnerable to pest attack than single stands;
- ◆ labour requirements are less, especially in reducing weeds;
- ◆ labour peaks are spread out;
- ◆ more moisture is retained in the soil;
- ◆ returns are higher per unit of land;
- ◆ successive sowing of crop mixtures supplies a mixed diet over an extended harvesting period.
- ◆ risk of crop failure is less;
- ◆ where labour is scarce the returns on labour are increased at the time of the year when labour is limited.



**Old lamps  
for new**

In villages, highly perishable food was bartered or sold directly from farms, with purchasers often coming to the farm. In larger villages, farmers sat with baskets of produce in a central place. Not-so-perishable food was sold in weekly bazaars which also served as meeting places and provided entertainment. The existence of weekly bazaars, allowed farmers and consumers to spend more of their time on their productive work.

There were middlemen who went around from village to village buying up the produce. Traders purchased fruits and vegetables by the headload to hawk around. There were special needs, like the leaves of the banyan tree collected for elephant fodder only.

Such practices also resulted in good agriculture. J A Voelcker, a British agricultural chemist, was brought to India as an expert to recommend improvements to be made in Indian agriculture. In his report of 1893, he stated:

“(N)owhere would one find better instances of keeping land scrupulously clean from weeds, of ingenuity in device of water-raising appliances, of knowledge of soils

and their capabilities, as well as the exact time to sow and to reap as one would in Indian agriculture; and this is not at its best alone, but at its ordinary level. It is wonderful, too, how much is known of rotation, the system of ‘mixed crops’, and of fallowing. Certain it is that I, at least, have never seen a more perfect picture of careful cultivation combined with hard labour, perseverance, and fertility of resource, than I have seen at many of the halting place in my tour”.

The agricultural scientist, Albert Howard, wrote early in this century that Indian farmers used compost and organic manures which ensured that they could continue farming on the same land for more than 2000 years without a drop in yields. He added that the crops “were remarkably free from pests” and that they were nearly as permanent as the primeval forest. Howard decided that he could not do better than watch the operation of the farmers, regarding them as his professors. From them he learnt how to grow healthy crops, practically free from disease, without the slightest help from artificial manures or insecticides.

***Source : Tending the Earth, Earthcare Books, Bombay, 1993.***

## A SOPHISTICATED AGRICULTURAL KNOWLEDGE

BERNARD DECLERCQ

The descriptions of Mr. Le Tavernier or of the Chinese travellers Fa Hien and Huang Tsang (18th century) about the marvel and opulence of India might be coloured with romanticism. But not so the many official reports, such as the Volcker report, or the figures found in the dossiers of the revenue departments.

In the 18th century Thomas Barnard, a British engineer, conducted a survey in Chengalpet district near Madras covering 800 villages. The results show the average yield of wet land rice to be 3600 kg/ha and 1600 kg/ha for dryland rice. In many villages out of these, yields surpassed 10,000 kg/ha (the present average is 3177 kg/ha).

In 1873, after the opening of the Suez Canal the first wheat arrived from India. The British envisaged India as a potentially secure source of wheat for the Empire (Dan Morgan: *Merchant of Grain*).

Though much rice and wheat were exported, domestic availability grew at

about the same rate (*George Blyn: India's Crop Output Trends, Past and Present*). The export of food grains rose from 8,58,000 pounds in 1849 to 19.3 million in 1914. Oilseeds export increased from 2 million to the staggering figure of 5 million in a period of 19 years.



We are all here, sir—fertilizer supplier, pest controller, seed adviser and soil tester—but I wonder who that man is standing over there!

Notwithstanding the loss of at least 113 of the inhabitants of the province (Bengal) and the consequent decrease of the cultivation, the net collection of the year, 1771 exceeded even those of 1768.. It was naturally to be expected that the diminution of revenue should have kept an

equal pace with the other consequences of so great calamity. That it did not, was owing to its being violently kept up to its former standard. (Warren Hastings 1772).

In 1889, in a report on the improvement of Indian agriculture for the Royal Agricultural Society of England, Dr. John Augustus Volcker stated: "There is little or nothing that can be improved.. I may be bold to say that it is a much easier task to propose improvements in English agriculture than to make really valuable suggestions for that of India. It is wonderful too, how much is known of rotation, the system of mixed crops etc.. Certain is it that I, at least, have never seen a more perfect picture of careful cultivation combined with hard labour, perseverance and fertility of resources.."

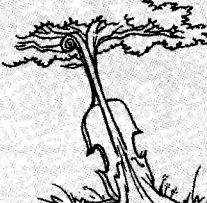
Dr. Wallick addressed a committee of the British House of Commons in 1832.

Question : Whether Indian agriculture was susceptible to any great improvement?

Answer : Certainly, but not to so great an extent as is generally imagined: for instance, in rice cultivation, I should think, if we were to live for another thousand years, we should hardly see any improvement in that branch of agriculture.

The sophistication of Indian agriculture then was considerably beyond the comprehension of the British administrators of the 18th century.

**Music should continue**



*Neem is now known to be effective against about 10 species of beetles, 10 species of flies, 25 species of butterflies and moths, 9 species of grasshoppers and locusts, as well as several species of aphids, fungi, leafhoppers, leafminers, mites, nematodes and termites - about 200 species in all. Practically all insects that consume plant parts are killed by neem, but others are repelled from feeding, develop deformities, or have their eggs destroyed.*

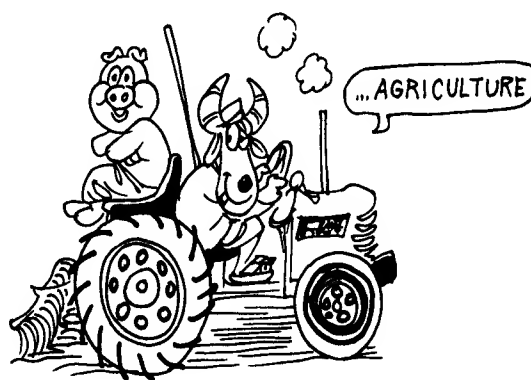
## PUTTING THE CLOCK BACK!

J.C. KUMARAPPA

A news agency report states that Prof. Einstein has sent a message to the people of our land warning us that chemical fertilizers and tractor ploughing will ultimately bring in loss of soil fertility causing incalculable and irreparable harm to the country eventually. Curiously enough the bearer of this message is Dr. Amarnath Jha himself.

Great many experts before Prof. Einstein have advised Western farmers against the use of these instruments of a short sighted policy. Our country is always about a century behind. What has been discarded by Western scientists, our experts cling to as the last word in progress. It would not matter much if our scientists were left to hold matter much if our scientists were left to hold their antiquated views in their laboratories, but the tragedy of it is our vested interests have used them for propaganda purpose and have induced our Government to squander crores of public money on importing tractors and establishing fertilizer factories.

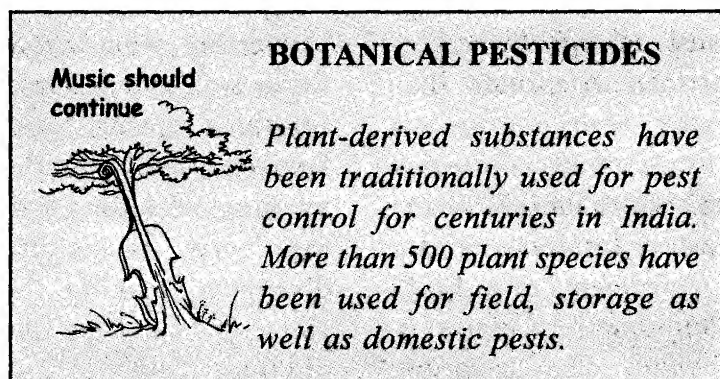
As it is, the pressure on land is such, that it is not able to provide adequate food for the people. What we need is a programme of rational use of land combined with provision of ample fuel resources to release farmyard manure for the fields. Instead we are faced with converting, what is today a reasonably fertile soil, into desert land by our greed for quick returns. No doubt the use of fertilizers will stimulate the soil into yielding more for a time but soon, like the energy of the drunkard, it will disappear, making the second state worse than the first. Shall we be guilty of killing the goose that lays the golden egg?



If it was merely Prof. Einstein's personal view it may be dismissed lightly. This opinion is the result of extensive use of fertilizers and tractors under very favourable conditions both in the U.S.A. and Australia.

We may remind our readers that not long ago Mr. Collin Grant Clark, the Australian economist, invited to advise our Government, said that he would

develop India on the basis of cottage industries regarding the factory as a necessary evil. Surely these men cannot be accused of being fanatical Gandhiites trying to put the clock back! Shall we heed the call of wisdom based on experience or go our own way to destruction? The impact of the West disintegrated our industrial set up. Is it left to a national Government to convert our fields into deserts? May God forbid.



## LAND IN INDIA

Indian villages are highly integrated systems of Ecology. What happens to one component affects others. However this system finely tuned as it is can be split apart. If too many trees are cut, or population pressures reduce the area of forests and grazing lands, there would be shortage of firewood. This would force people to burn cowdung, leaving little manure to fertilize crop lands. As fodder sources decline, animals will starve and will not produce enough cowdung. All these add up to reduction in the production of biomass. The land area is converted into a pseudo desert.

India has 129.78 million hectares (mha) of wasteland of which 35.92 mha is degraded forest land and 93.86 mha of degraded nonforest land. We should try earnestly to increase the productivity of all components of the village ecosystem, and in a sustainable manner.

Promoting an integrated village ecosystem through planning and management is the way. This has to be done at the village, by the villagers in a participatory manner. Examples of Sukhomajri village in Haryana,

Ralegaon Siddhi in Maharashtra, Jhabua in M.P. etc.

|   |                  |
|---|------------------|
| 1) India land area  | 328.73 mha       |
| 2) Report available   | 304.89 mha       |
| 3) No biomass production                                    | 41.38 mha        |
| 4) Biomass producing area                                   | 265.31 mha       |
| 5) Biomass producing area as a percentage of reporting area | 86.43 %          |
| 6) Biomass producing common land — Forest                   | 68.83 mha        |
| Culturable wasteland  | 14.10 mha        |
| Permanent Pastures/ grazing lands                           | <u>11.05 mha</u> |
| Total   | <u>93.98 mha</u> |
| 7) Biomass producing private land                           | 169.52           |
| 8) Biomass producing common land as a % of reporting area   | 30.82 %          |
| 9) Forests  | 68.83 mha        |
| Not available for cultivation                               | 41.38 mha        |
| 10) Area sown   | 142.21 mha       |
| Area sown more  |                  |

|                         |            |
|-------------------------|------------|
| than once               | 44.35 mha  |
| Total cropped area      | 186.56     |
| Irrigated area          | 71.51 mha  |
| 11) Total wasteland     | 129.57 mha |
| Degraded forest area    | 35.85 mha  |
| Degraded nonforest area | 93-66 mha  |

– saline alkaline/wind eroded/water eroded 7.17 mha 12.92 mha 73.58 mha

India has 2.5% of world's land. But India supports 50% of world's buffaloes, 16% of world's population, 15% of world's cattle and goats. More and more grazing land is being brought under plough. The remaining lands move towards overstocking, overgrazing and ecodisaster. The degeneration of grazing lands has led people to keep goats in preference to cattle. Because goats survive better in hostile environment. In 1951 there were half the number of goats as cattle in Rajasthan, 1983 there were 14 goats for every 10 heads of cattle.

As fodder becomes scarce people turn the animals to forests. This leads to corruption of foresters and fight between villages.

Nomads, and their animals suffer most, as they had to travel longer distances for grazing. Ultimately they lose the animals and become landless labourers.

Nomads are recognized by the scientists to be the best users of fragile and



**Nomads are the best users of fragile and arid lands.**

arid lands. But governments make the nomads settle on marginal lands which would ultimately collapse under permanent agriculture.

Social forestry programmes such as monoculturing of eucalyptus trees, do not help in solving the serious problem of fodder shortage. Our priorities and techniques are wrong.

India's wastelands, affected by alkalinity, salinity, wind and water erosion are still cultivated upto 42% leading to their further degradation.

Ravines swallow up millions of hectares. In Chambal valley 10% of the villages are completely depopulated.

Mineral production has increased from 1952-82 by fifty times in rupee value. But several million hectares of crop lands and



forest lands have been lost and hundreds of villages have been depopulated. Urbanisation also causes encroachment into agricultural, and forest lands cutting agro production.

More than half the mineral wealth of the Nation comes from Central and Eastern Indian districts, where the tribal people live.

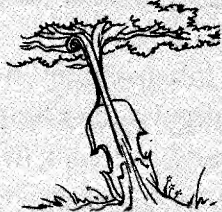
#### India's use of Agrochemicals 1996-97 (million tonnes)

|           | Production | Import  | Consumption |
|-----------|------------|---------|-------------|
| Nitrogen  | 8.71 mt    | 1.16 mt | 10.30 mt    |
| Phosphate | 2.60 mt    | 0.22 mt | 2.98 mt     |
| Potash    | —          | 0.67 mt | 1.03 mt     |

Production of insecticides, fungicides, weedicides, rodenticides, fumigants, plant growth regulators.

1996-97 — 94,350 tonnes. 1997-98 — 82,500 tonnes.

Music should  
continue



*The potential for organic manures today in India is large. The five major crops – paddy, sorghum, wheat, pearl millet and maize – alone are estimated to yield approximately 140 million tonnes of straw, and the legumes another 10 million tonnes. The nutrient potential of cereal straw and residues is 0.7 million tonnes of nitrogen (0.5%), 0.64 million tonnes of phosphorus pentoxide (0.6%) and 2.1 million tonnes of potash (1.5%).*

# **LAND-USE SYSTEMS AND BIODIVERSITY**

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**NIGEL J.H. SMITH**

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## **I. INTENSIVE CROPPING WITH SHORT CYCLE CROPS**

**T**his involves high input modern farming, monoculture, mechanisation and agrochemicals. This diminishes biodiversity, destroys many beneficial insects and soil micro-organisms. Chemicals pollute water and destroy fisheries and paddy systems. They also reduce organic matter in the soil impairing its capacity to retain moisture. The soil loses its capacity to store nutrients and becomes less friable for root penetration. A rapid turnover of varieties has also not helped.

## **II. SHIFTING AGRICULTURE**

This causes deforestation and biodiversity loss.

## **III. AGROPASTORAL SYSTEMS**

Cattle ranching in humid tropics is the main cause of habitat destruction and biodiversity loss.

## **IV. AGROFORESTRY**

It is one of the more sustainable land use systems for the tropics especially in degraded areas. Mixed tree crop farms are better protectors of biodiversity. Agroforestry with two to ten species of inter-cropped annuals and perennials is best recommended for maintaining biodiversity.

## **V. PLANTATION SYSTEMS**

Plantation Systems of Rubber, Oil-palm, Eucalyptus, and Cocoa speed up deforestation and loss of biodiversity.

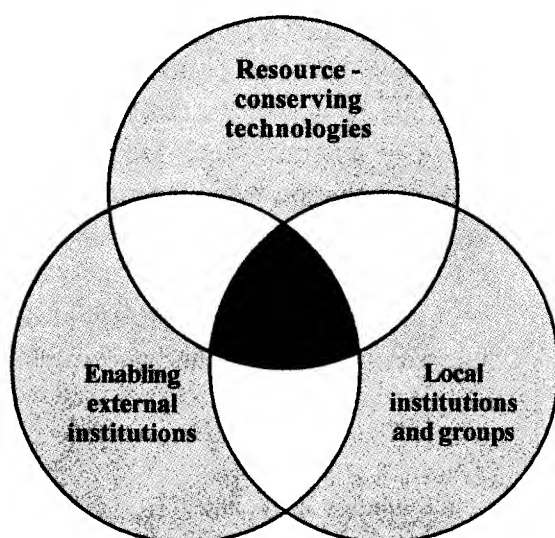
## **VI. MANAGED FORESTS**

The remaining forests represent an extensive pool of largely unexploited biodiversity. But most woodlands in the tropics and subtropics are under severe pressure from farmers, ranchers or loggers.

## **VII. POLICY IMPLICATIONS**

1) Conservation and natural resource management are not separate

### FAVOURABLE POLICY ENVIRONMENT



*Note :* Agriculture can only be persistent and sustainable when resource-conserving technologies are developed and used by local institutions and groups, who are supported by external research, extension and development institutions acting in an enabling way. For sustainable agriculture to spread, the wider policy environment too must be enabling.

**Sustainable agriculture**

issues for policy makers and stake holders.

2) More research is warranted on genetically diverse populations of crops and animals on managed landscapes.

3) Farmers and livestock owners should be involved in fixing research priorities.

4) Undervalued plants and animals should be assessed in a better manner.

5) A better study of past agricultural systems should be organised to understand

how our forefathers balanced productivity and biodiversity.

### VII. INDICATORS OF BIODIVERSITY CONSERVATION

- 1) Natural habitat loss.
- 2) Habitat fragmentation.
- 3) Species loss even when natural habitat is still intact.
- 4) Decline of biodiversity of crop species on farms.
- 5) Decline in biodiversity within species.

## PRESERVING GLOBAL CROPLAND

**GARY GARDNER**

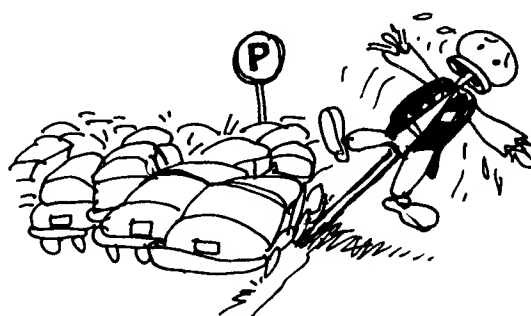
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**I**n 1981 the croplands of the world measured 732 million hectares as a culmination of thousands of years of expansion of grainland under cultivation. Then between '81 and '95 the harvested grain area fell by 7.6%. A surge in grain prices pushed the grain area up in 1995. Today it has levelled off at 695 million hectares. Cropland (grainland plus all other land for crops) today stands at 1.4 billion hectares. Land expansion has ended today. Now humanity has to rely on a single source of growth - rising yields. Supply failures will hit humanity very hard. Grain areas per capita shrank by 30% between 1950 and 1981 to 0.16 hectares. But after 1985 yield growth has also started faltering. In 2000, grain harvested area per person is 0.12 hectares and falling. Caring for soils and preserving cropland have become urgent necessities.

Expanding cities encroach on prime and highly fertile cropland. Construction of factories, houses and roads and the development of recreational areas take a toll on cropland. China lost 5% of the national land that is 6.5 million hectares of

arable land to non-farm purposes. This trend continues from Asia to America.

Growth of transport spurs on the construction of roads and parking lots on



Growth of transport spurs on the construction of roads and parking lots on farmlands.

farmlands. China, Vietnam, India and Indonesia, are countries where private automobiles eat away agricultural lands. Asia found new interest in golf, a space consuming sport.



Golf: A space consuming sport

Land degradation in the form of erosion, compaction, contamination, salting and water logging is affecting ever-widening tracts of croplands. The thin layer of earth called topsoil is essential to land's fertility. Though it is only 15 cms. deep, topsoil is a rich medium containing organic matter, minerals, nutrients, insects, microbes, worms, and other elements needed to provide a nurturing environment for plants. Loss or disruption of this soil community through erosion or other forms of degradation impair soil fertility over time. Today 38% of global cultivated area that is 552 million hectares had been damaged to some degree by agricultural mismanagement. The worst areas were lost to agriculture, that is, 86 million hectares that could have fed 775 million people. Other degraded lands continue to produce at the cost of their fertility. Erosion, deforestation and salinization, continue to dog agricultural prospects. Some land ultimately goes over the edge. There comes a stage when a country has to depend heavily on imports. Malaysia, North Korea, Taiwan, Japan, China, and Indonesia are major importers of foodgrains. U.S., European

Union, Canada, Argentina, and Australia, account for 80% of the world's grain export. In the process they have gained much diplomatic leverage. The supplier nations and self-sufficient nations like India have very little scope for agricultural expansion. Food being a vital necessity, agricultural land has become a strategic resource as important as oil-reserves or armed forces. Soil conservation, land upgradation, legal support, for protecting cropland have become urgent necessities.

Pressure on agricultural land can be minimised by lowering grain consumption; this in turn by lowering the intake of meat and milk, the grain intensive foods. 40% of grain produced in the world is fed to livestock, poultry of fish. Decreasing consumption of these products, especially of beef, could free up massive quantities of grain and reduce pressure on land. Every kilogram of beef left uneaten can free sq. metres of land. After all, culture makes perfect economic sense.

*From : State of the World 1997,  
W.W. Norton & Co., New York.*

## FOREST RESOURCES

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**DR. G. SANTHANAKUMAR, READER, S.T. HINDU COLLEGE, NAGERCOIL.**

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### INTRODUCTION

Nature has provided innumerable resources to man which are economically important as he depends on them either directly or indirectly. Natural resources can be defined as all natural things given by nature on, above and under the surface of the earth. In other words, natural resources may be anything found by man on the earth in natural environment. He utilizes such things for his own benefits.

The increase in population explosion is the main reason for depletion of resources. It must be understood that resources are not inexhaustible. If resources are exhausted it will result in a great setback in economy and also in ecology.

### KINDS OF RESOURCES

Resources are mainly classified into two. They are renewable and non-renewable resources. Renewable resources of the Biosphere are replaced from time to time by natural multiplication. Resources like vegetation, water, wind, etc. are

examples of renewable resources. At the same time some of the resources like fossil fuels, minerals etc. when once used are lost for ever. It will take millions of years for these resources to regenerate on this planet.

### FOREST RESOURCES

The life of man and his progress have been profoundly influenced by the presence or absence of forest or their relative abundance or scarcity. Man is able to meet almost all his demand from the forest. Hence according to an old adage, "Life will exist as long as forest exists."

Human needs like fuel, fodder, fruit, fertilizer, fibre (also pulp) timber, etc. are met with from forest origin. Apart from that trees with large leaves and canopy provide the protection of the soil from wind and soil erosion. The role of trees, particularly of their roots in preventing soil erosion is well known.

The role of trees, particularly of their roots in preventing soil erosion is well known. It is also a known fact that leaves

recharge the atmosphere with life-giving oxygen by consuming carbondioxide and transmit moisture to the atmosphere through the process of transpiration. These facts about the forest ecosystem must be known to every human who is really interested in the environment and conservation.

### **REASONS FOR THIS RESOURCE LOSS**

Felling the trees, exploiting and exporting the log has been started even from the British regime. This they have done just to meet their financial crisis (to meet the revenue requirements of the colony) and also to meet timber and fuel requirements.

It is very pathetic to note that the total forest area of the world which was estimated in 1900 as 7000 m.ha and of India is 63.3 m ha. According to another estimate India is losing forest cover to the tune of 15 m.ha/yr. It is also estimated that 15,000 ha forest cover is destroyed annually to development projects.

Industrialisation resulted in increase in the commercial exploitation of the forests. Coupled with large tracts of plain as well as hilly areas being converted into agricultural land, the building of industrial infrastructure and growth of cities and towns along with the over exploitation of the hill

areas by the tribals, has reduced forest cover to 14.12 per cent of the total geographical area. When we look into the present scenario of forest, it shows a deplorable state. Remote sensing shows only 11 per cent of forest exist in our country. Even in 1976 National Forest Policy insisted that our country must aim at 33 per cent cover for the welfare of the nation. The earth's mantle of forests and wood-lands has shrunk by a third.

Forests are our treasures, which provide us a wide variety of commodities and play a major role in the ecological balance. No secondary forest or plantation can compete with the biological richness or ecological importance of primary forests.

### **MANGROVE DEFORESTATION**

It is time to consider mangrove resources also under the forest resources. This forest resource of coastal wet land is of great concern for the renewability of living organisms of the capture fisheries resources and also in prevention of coastal erosion. Present scenario of mangroves are also under threat. India is having 6,740 km<sup>2</sup>. But 70% East coast, 12% West Coast and 18% Andaman and Nicobar islands.

Details of may be irrelevant. One of the reasons which has been attributed

for the super cyclone of October 29, 1999 in Orissa is reckless removal of coastal mangroves for shrimp culture and for fuel purpose. The cyclone resulted in loss of lives and also created a vicious socio-economic-environment cycle.

### **FOREST AND ITS RELATION WITH ENVIRONMENT - WATER CYCLE**

The green canopy of the forest ecosystem plays an important role in the water cycle. The evapo-transpiration of the forest cover is responsible for the formation of "seed cloud". Thus the green canopy is very important in the formation of micro-climate by means of which we get rain.

During the rainy period the striking force of the falling water drops are reduced by the tree cover. By arresting the force of the dropping water particles the speed of the flash flood is reduced. At the same time it prevents the soil from being eroded. If the speed of the running water from the forest is reduced, it permits the surface of the earth to absorb more water. This percolated water increases the ground water table. Simultaneously the ground flora, herbs and shrubs along with tree trunks of the forest environment prevent the flash flood and siltations dams.

### **SILTATION**

Siltation of dams and reservoirs is a common phenomenon. But deforestation will enhance this process. For example: it has been observed a positive correlation between the loss in storage capacity of Hirakud reservoir and forest loss. Due to excessive silting Hirakud reservoir will have life of 77 years instead of the original estimate of 111 years.

### **O<sub>2</sub> AND CO<sub>2</sub> BALANCE**

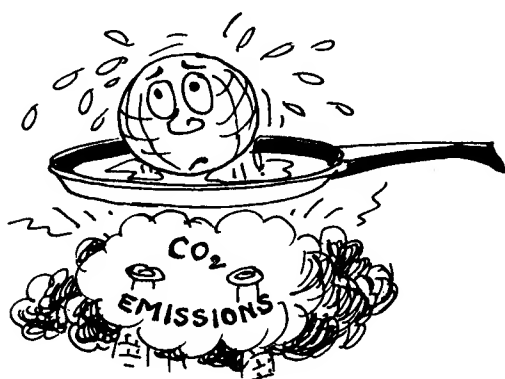
Forest ecosystem plays an important role in the maintenance of O<sub>2</sub> and CO<sub>2</sub> balance. CO<sub>2</sub> from different industrial activities are emptied into the atmosphere. If the CO<sub>2</sub> level exceeds the limit, it is precarious to the health of all living organisms and also gaseous



Forest ecosystem is described as  
**green lungs** of the earth



balance of atmosphere. This  $\text{CO}_2$  is mostly utilized by the green canopy of the forest cover during photosynthesis. Thus it utilizes the  $\text{CO}_2$  in turn releases oxygen. Hence often the forest ecosystem is described as green lungs of the earth. If the  $\text{CO}_2$  level exceeds the limit it is also responsible for the global warming. That is the  $\text{CO}_2$  of the atmosphere will hold the heat energy of IR rays of the solar radiation (even during the reradiation of IR). It has been estimated that after the industrial revolution utilization of fossil fuel increased the global atmospheric  $\text{CO}_2$  level. This rise is about  $0.5^\circ\text{C}$  in every decade. At this rate if the  $\text{CO}_2$  emission goes on, in 2100 A.D.



the global temp will be  $4^\circ\text{C}$  more than what prevails now. The major impact of this will be the sea-level rise due to polar ice cap melting. This rise in the sea level may be responsible for the sinking of low lying islands. Global warming will also cause increased requirement of water in wetland crop like paddy. So this may increase more of economy input in agriculture sector from

irrigational point of view. Another important impact will be loss of ozone. If sufficient amount of  $\text{O}_2$  is not available the net result will be ozone depletion. Ozone is the protective layer surrounding the planet



O-zone layer protects the earth from the UV radiation from the solar rays.

earth; responsible for the prevention of UV radiation from solar rays. This ultra violet radiation is mostly prevented or absorbed in the ozone layer itself. If it is not prevented the incoming UV rays may cause skin burn, alteration of genetic composition in chromosome and causing cancer. Hence sufficient amount of oxygen liberated by plants is not only essential for living organisms to breathe in also for the sustenance of ozone layer.

### BIO-DIVERSITY

The immediate impact of deforestation may lead to the loss of bio-

diversity. Particularly the tropical rain forests are having rich diversified fauna. The destruction of the forest cover means, the habitat loss for the wild life. Moreover, most of the herbs used for preparing for the medicinal purposes are obtained from the forest environment. Thus by means of deforestation we are losing the medicinal plants. Scientists at the Kew gardens in Britain listed around 20,000 plant species as threatened to their life. Another estimate of IUCN reveals that by 2050 A.D the plant species which are "threatened" will become extinct.

### DEFORESTATION - TRIBALS

Tribals looked upon themselves as an integral part of nature. It is imperative here to critically examine this relationship because there has been a continuous shift in the individual - community - nature relationship with the progress of civilization. The deforestation has disturbed the tribal life. It must be remembered that tribals are the custodians of forest. Because of intensive deforestation their habitat has been disturbed. It is also important to analyse the reasons and processes involved in integrating the tribal community into the mainstream and the accompanying changes in the man - community - environment relationship. To save the

forest - environment from the modern industrialist, many environmental groups arose. There have been numerous forestry related protests earlier in the country. But all these had focussed on demanding greater immediate privileges for the local people and not raised fundamental issues regarding the whole social system of resource use. The Chipko and Apiko movements did so. To meet the wood demand of different people and industries the concept of social forestry was developed. But this concept did not aim at the goal of the demand of people with regard to forestry products. To give an example, plants and trees were raised like eucalyptus. This has setback in environment and also it was able to meet the demand of industries and not the people's requirements.

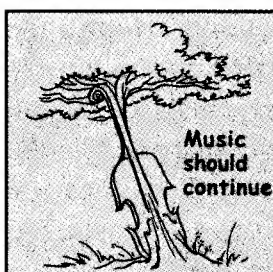


### CONCLUSION

Extinction of different plant and animal species have been a fact of life

since life first emerged. Giant and mighty Jurassic animals ever also met with extinction. The present million species of organisms are the modern - day survivors of the estimated half-billion species that have existed. Almost all past extinctions have occurred by natural processes, but to-day human activities are responsible for the extinction of forest resources along with faunal resources. In preserving each plant and animal species, cultural values were given importance. Based on that each temple of India

particularly of Tamil Nadu is having one plant as "Sthalavirutshakam". Likewise in most of the Hindu temples animals were also given importance in the worship. This is merely to offer gratitude for what they have done to humanity. It is also nothing but to arouse the sense of conservation among the worshippers. The Sthalavirutshakam concept is one way of gene preservation which is equivalent to the "Clonal Bank" of modern methods. Let us understand nature and its relation to human welfare.



*Neem cake, for instance, has 5% nitrogen, 2% phosphate and 10% potash. Neem cake also protected crops from soil pathogens and its chemicals were absorbed by the plants to serve as systemic insecticides.*

## HIMALAYAN SIZED CHALLENGES

ANIL AGARWAL, SUNITA NARAIN

**T**he deep gorges of Himalayan rivers seem sufficient to transport excess rainwater. Surprisingly this is not true. Floods have been taking place in the Himalayan mountains from time immemorial.

Landslides often block Himalayan rivers. When these landslide dams burst they cause a flood pulse which triggers off more landslides.

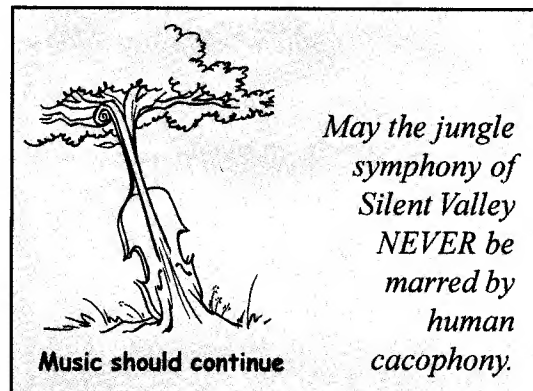
In 1893 a landslide blocked the Birahiganga in the Uttar Pradesh Himalaya to form a 350 m high dam creating the vast Gohana Tal. When a part of the dam toppled 10 months later, the level of the Alaknanda rose by 50 m and washed away the town of Srinagar.

During a normal year, some 0.5 mm to 5 mm of soil depth gets washed away in the Darjeeling Himalaya. During a year of catastrophic floods, such as in 1968, some 20 mm deep soil can get eroded. Hardly any mountain range in the world experiences such high erosion rates.

Cyclonic storms in Darjeeling and Sikkim can bring 310 mm to 1,800 mm of rainfall in a day. Cloudbursts exceeding 1,000 mm in a day can trigger massive landslides in practically any geological circumstance.

The Teesta flowing through the Sikkim and Darjeeling mountains is possibly the wildest river in the Himalaya. After the destructive floods of 1787, the Teesta, which used to flow into the Ganga, changed course and started flowing into the Brahmaputra.


*From : Floods, Flood Plains and Environmental Myths.*




## A NEW DIRECTION IN CALCULATING THE PRODUCTIVE VALUE OF TREES


SARALA DEVI

**I**n his presidential address to the Agricultural Science Section of the Indian Science Congress at Varanasi in 1981, Professor Dr. T.M. Das suggested a striking new direction for calculating the productive capacity of a tree. So far we have imagined that the financial benefits we derive from trees are confined to their annual produce of fruit etc., or their end value as fuel or timber. We have also considered these uses to be our birthright, with no responsibility for their maintenance or renewal. We have completely ignored the question of the great ecological contribution of trees to the environment, and this may be why in many circles we are so indifferent to their large-scale destruction. The calculations suggested by Dr. Das can save to open our eyes in this direction. His calculations are based on the very conservative calculation of the 50-year adult life of an average dimensional tree of 50 tonnes weight.

 **Production of oxygen:** During the process of photo-synthesis six molecules of oxygen are liberated for every molecule of glucose synthesised. The

majority of the oxygen is subsequently liberated into the atmosphere. For such a tree this would amount to at least one tonne of oxygen in the course of a year, which at the current price of oxygen would equal Rs. 5000, or Rs. 250,000 in the course of fifty years.

 **Control of atmospheric pollution :** So far no satisfactory technical method has been evolved for the general purification of the atmosphere. We are almost entirely dependent on trees for this important function. Even if a satisfactory technical method could be evolved, it would involve considerable expenditure of energy (which would incidentally be a further source of pollution) and on manpower. If one assumes this contribution of the tree to be Rs. 10,000 p.a., in the course of 50 years this would amount to Rs. 500,000.

 **Control of soil erosion and maintenance of fertility:** A medium sized tree with its complex root system can check the erosion of minute soil particles from an area of 100 sq. metres.

This prevents the silting of rivers and dams, thus reducing the danger of damage from floods. The tree also enhances soil fertility by its end products and the droppings of its inhabitants. To replace this function by man-power and the manufacture of organic manure might involve an annual expenditure of Rs. 5000 or Rs. 250,000 in 50 years.



**Recycling of water and control of humidity:** In the course of the production of one gramme of dry

matter, 300/1000 grammes of ground water are transpired through the leaf surfaces. This increases the humidity and decreases the temperature of the atmosphere, inducing cloud formation and eventually rainfall. Pumping such an amount of water from underground sources would involve expense on energy and man-power, the running cost of which could probably be about Rs. 6000, or Rs. 300,000 in fifty years.



**Bird and animal shelter :** On an average ten pairs of birds and six pairs of squirrels, with mosses, algae, fungi etc., can shelter in a medium-sized tree. Rearing these by artificial means would involve the use of manpower and capital expenditure. Maintenance alone would probably amount to Rs. 5000 p.a., or Rs. 250,000 in 50 years.



**Protein conversion :** The green matter produced by an average

tree is sufficient to supply the daily nourishment of a pair of kids. At the end of the year their average weight would be 25 kilograms. At present prices of meat this would fetch Rs. 4000 or Rs. 20,000 in 50 years.

Therefore excluding the income from fruit, flowers or other recurring or end-products, the value of the services rendered by a tree may be calculated as under: -

|  |             |
|--|-------------|
| Production of oxygen                       | Rs. 250,000 |
| Control of air pollution                   | 500,000     |
| Control of soil erosion and soil fertility | 250,000     |
| Bird and animal shelter                    | 250,000     |
| Recycling of water and control of humidity | 300,000     |
| Protein conversion                         | 20,000      |

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Rs. 1,570,000

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Although these calculations are in a way in the stage and speculation, they are significant of the cost in energy and man-power which can be involved as a result of the present rapid rate of destruction of our forests. Does the man in the street yet realise to what an extent our own survival and that of our children is dependent on the maintenance of the purity of the atmosphere?

**From: Revive Our Dying Planet, Gyanodaya Prakashan, Nainital, 1982.**

## FORESTS

India is losing forest at the rate of 1.3 mh. per year at the rate of eight times the government is quoted to lose.

Wood shortage for common industries, fishing, making bullockcarts, crafts making, has driven people already poor to despair.

Wood-based industries, mines, dams threaten the tribals and their way of life, by destroying their forests-homes-habitats.

India is already spending colossal amounts on afforestation with mixed results. Monocultured, single variety forests are plantations, which do not qualify to be called forests. They do not support the biodiversity desired. They feed paper mills, wood-based (ply type) industries. They do not make forest homes for human beings.

Social forestry programmes are popular with farmers initially. But in the process, the fuels like cotton stalk, which were available free of cost to landless labourers are no more grown.

Eucalyptus the symbol of monocultured forest, is hated by



Eucalyptus robs the soil of nutrients and kills smaller plants.

environmentalist. Eucalyptus robs the soil of nutrients, kills smaller plants and does not support varieties of plants, bushes, grasses etc.

Afforestation could be great source of employment of landless labourers. 50 lakhs to 1 crore of them.

Dense forests in India covered only 12% of the land area in 1997. This is far below the target of 33%.

Some success has been achieved in arresting the decline of natural forests. In 1980 India had 55.12 mha of natural forests. In 1990 the figure was 51.73mha.

Indian forests account for its richness of biodiversity not only to Brazil and Malaysia. It is important to focus in the pristine untouched forests (30.5% of the country's land area) if we want to safeguard our Biodiversity.

Private plantation companies, which ventured in a big way, in teak wood cultivation outside forest area could have served the nation well. But they botched up the affair leading to the loss of 2500 crores of rupees of investors money. More than that loss of credibility led to a setback of the afforestation process.

Failure to involve the local people in the management of forest resources led to the space being taken over by brigands, dacoits and forest thieves, sandalwood smugglers, elephant poachers.

Several outbreaks of forest diseases has not woken up the concerned people. Sal trees died in thousands because of borer diseases. Forest science research is urgently needed.



Failure to involve local people in the management of forest resources led to the space being taken over by brigands, forest thieves, sandalwood smugglers and elephant poachers.

## Forests of India

1993-95 recorded forests 76.5 mha. (actual cover 63.34 mha)..

Reserved forests 41.65 mha

Protected forests 22.33 mha

Unclassified forests 12.54 mha

Actual forest cover percentage to geographical area 19.27% (against the required 33%).

India mangroves ('95) 0.48 mha

Forest scrub lands 5.72 mha

25 districts in India have no forest cover at all.

## How forest land is lost?

To agriculture, river valley projects, industries, townships, transmission lines, roads, miscellaneous.



|             |                        |
|-------------|------------------------|
| Total from  |                        |
| 1951 - 1980 | 4.328 million hectares |
| 1980 - 1994 | 0.33 million hectares  |

This proves that the forest conservation act does have some effect.

## INDIA'S FOREST PRODUCTS

### Non timber products

(1) Bamboos (2) eucalyptus oil (3) fibres, flosses (4) ghatti and other gums (5) grasses (6) gums (7) katha (8) lac (9) Lemon grass oil (10) mahuva oil (11) myrobalans (12) neem seeds (13) other seeds (14) Palmarosa oil (15) resin from pines (16) rosin (17) sal oil (18) sal seeds (19) sandalwood oil (20) tendu, beedi leaves (21) tans, drys, catch (22) turpentine (23) wild edible products.

In 1993 Total value of Non-timber forest products in

|            |                         |
|------------|-------------------------|
| India was  | Rs. <u>7,859 crores</u> |
| Firewood   | Rs. 6,213 crores        |
| Other NTFP | Rs. <u>1,646 crores</u> |

### India burns a lot of firewood

|                      |            |              |
|----------------------|------------|--------------|
| Fuelwood consumption | 2001 - 180 | million tons |
| Cottage industries   | 1996 - 25  | million tons |
| Rituals              | 2001- 40   | million tons |
| Hotel                | 1996 - 10  | million tons |
| Total                | 255        | million tons |

### WE NEED A LOT OF TIMBER TOO

|                               |                              |
|-------------------------------|------------------------------|
| Housing, packaging furniture, |                              |
| agri-implements               | 2001 60.4 million cubic tons |
| Industrial wood,              |                              |
| pulpwood, plylogs             | 12.6 million cubic tons      |
| Total                         | 73.00 million cubic tons     |



They chop down 100ft. trees  
To make chairs  
I bought one  
I am six-foot one inch  
When I sit on the chair  
I am four foot two  
Did they really chop down a 100ft. tree  
to make me look shorter?

— Spike Milligan

## HUMAN-MANGROVE INTERACTIONS: ECONOMIC BENEFITS AND ECOLOGICAL IMPACTS

| Activity                 | Mangrove dependent groups/ sectors | Uses of mangrove ecosystem                | Output / products                        | Stress on mangrove ecosystem |
|--------------------------|------------------------------------|---|--|------------------------------|
| Fishing                  | a) Fishpond owners                 | a) Creating fishpond                      | Fishery products                         | Cleared area                 |
|                          |                                    | b) Fry collection for stocking            | Fishery products                         | Forested area                |
|                          | b) Fisherfolk                      | a) Collection of adult fish, Shrimp, etc. | Fishery products                         | Forested area                |
|                          |                                    | b) Fish for consumption                   | Household nutrition security             | Forested area                |
|                          |                                    | c) Tanning collection                     | Increased durability of fish nets        | Forested area                |
| Farming                  | a) Farmers                         | a) Rice cultivation                       | Higher rice yield                        | Cleared area                 |
|                          |                                    | b) Manure                                 | Substitute for chemical fertilizer       | Damage (?) (Qty)             |
|                          |                                    | c) Solid and water pollution              | Agricultural output                      | Damage (Qty)                 |
|                          |                                    | d) Coastal protection                     | Land saved from coastal protection       | Forested area                |
|                          | b) Other rural groups              | a) Feed for cattle                        | Energy for farm operation, milk, etc.    | Damage (?) (Qty)             |
|                          |                                    | b) Fuelwood collection                    | Energy for household use                 | Damage (?) (Qty)             |
|                          |                                    | c) Honey & herbal medicine                | Additional income and income saving      | Forested area                |
| Logging                  | a) Businesspeople                  | a) Commercial wood cutting                | Building materials, charcoal, etc.       | Damage (Qty + Qty)           |
|                          | b) Other rural groups              | b) Wood cutting for own household needs   | Building materials                       | Damage (?)                   |
| Developmental activities | a) Industry                        | a) Wastage disposal                       | Industrial products                      | Damage (Qty)                 |
|                          |                                    | b) Oil spillage                           | Oil products                             | Damage (Qty)                 |
|                          | b) Urban development               | a) Ports                                  | Enhanced trade                           | Cleared area*                |
|                          |                                    | b) Roads                                  | Communication                            | Cleared area*                |
|                          |                                    | c) Housing                                | Houses                                   | Cleared area*                |
|                          |                                    | d) Sewage disposal                        | Cost saving                              | Damage (Qty + Qty)           |
|                          | c) Recreational                    | a) Beach hotels & resorts                 | Foreign exchange earnings                | Cleared area*                |
|                          |                                    | b) Canoeing, bird watching, etc.          | Aesthetic satisfaction, recreation, etc. | Forested area                |
|                          | d) Scientists                      | a) Research                               | Knowledge                                | Forested area                |
|                          |                                    | b) Preservation                           | Biodiversity                             | Forested area                |
|                          | e) Others                          | a) Mining                                 | Mineral products                         | Damage (Qty + Qty)           |
|                          |                                    | b) Salt production                        | Salt & employment                        | Cleared area*                |

**Notes :** \* Destructive uses whose ecological impact is a function of the scale of operation.

**- The Challenge of the Balance**

- R. Maria Saleth, Institute of Economic Growth, New Delhi.

## **ANIMAL HUSBANDRY**

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**WININ PEREIRA**

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**L**ivestock are an essential component of sustainable farming since they are required to recycle crop residues. The nutrients that they do not retain for their own growth and products, are quickly turned into manure which can go back to the soil. The manure provides nutrients for the next crop and enhances organic content and tilth.

Farmers normally maintained poultry, ducks, pigeons, pigs, goats and / or cattle. These provided, in addition to manures, meat, milk, cash, manures, and hides.

There were also the nomadic herders who provided manure for farmers' fields. Many of them developed and maintained the breeds suited to the region.

### **DRAUGHT ANIMALS**

The breeding of cattle mainly for their ability to provide draught power, not solely for meat or milk, perhaps unconsciously, acknowledged that we do not have enough resources to produce milk and meat on a large scale.

### **MEAT AND MILK**

Livestock farming for meat is being promoted here mainly in order to earn foreign exchange. But animals convert vegetable matter into meat very inefficiently. To produce a kilogram of meat, 6 to 9 kg of vegetable proteins are required?

The Anand Milk Scheme of the NDDB, held up as the shining example of what cooperative dairying can accomplish, has been shown to be impoverishing its own members. Good irrigated food crop land has been converted to green fodder production, food grains that can be consumed directly by people are fed to cattle, and a considerable amount of harm is done to the environment. With dairy animals requiring intensive care, the living standards of poor farmers are being dropped in order that the living standards of crossbred cows can rise.

The enthusiastic promotion of milk production as a profitable industry, with sales depending on distant markets, also requires the use of unsustainable transport and refrigeration.

The indigenous genetic resources are being damaged, with many breeds of traditional cattle, which were selected for providing both milk and animal power, being decimated. The use of genetic

engineering for livestock "improvement" will reduce the natural diversity further. Such a reduction has already occurred in Europe and is fast occurring here.

*Source : Tending the Earth.*

### COW DUNG, WEALTH OF THE COUNTRY



Old lamps for new

1. According to GB Pant University of Agriculture and Technology, Pantnagar estimates, about 200 million tonnes of dry matter must be produced annually in the form of bovine dung which on the basis of normal analysis should provide about 2 million tonnes of nitrogen or equivalent of 4.35 million tonnes of urea, 1.6 million tonnes of potash and 1 million tonnes of P2O5.
2. On an average adult bovine excretes daily about 40g of urea in the urine which means the total bovine population in this country excretes about 2.9 million tonnes equivalent of urea, which is a huge nitrogenous resource.
3. Use of urine in combination with commercial urea for treatment of crop residues, improved the quality of roughages in terms of increased digestibility of dry matter and cell wall contents.  
  
This resulted in reducing the urea requirement for treatment of crop residues by about 45% besides being less hazardous from animal's health point of view.
4. The total quantities of NPK which could thus be had from Dung/Urine are:
 

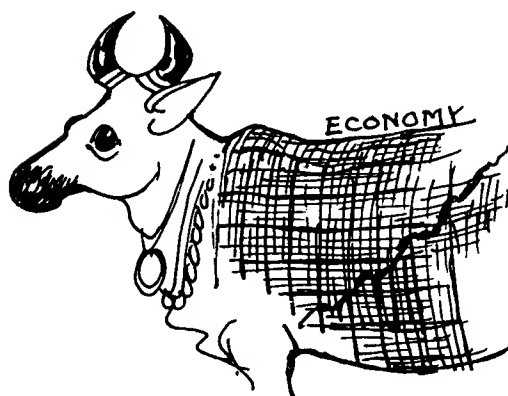
|            |   |                     |
|------------|---|---------------------|
| Urea       | - | 7.25 million tonnes |
| Potash     | - | 1.60 million tonnes |
| Phosphorus | - | 1.00 million tonnes |

**- Shri Lakshmi Narain Mody.**

## THE SECULAR COW ECONOMY

VENISHANKAR M. VASU

1. Our country's economy is cow based, carrying on farming and



Secular cow economy

transport with bullocks and obtaining nourishing food from the cow.

2. The total area of our country is 32.6 crore hectares; Ew distance of 2977 km and NS distance of 3219 km. Today (11.5.2000) India's population is 100 crores. 87% of our people live in 5,66,878 villages.
3. The pivotal cow influences the economy in (a) farming and manure

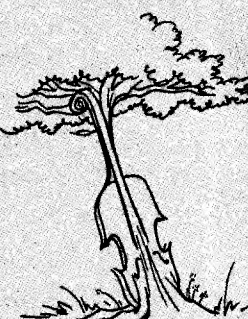
(b) food and nourishment (c) transport (d) fuel (e) housing and medicinal usage.

4. The bullocks of India plough nearly 40 crores of acres (16 crores hectare). To carry out the entire operation through tractors we might require 50 lakhs tractors. It will be more advisable to export steel and continue will bullock farming.
5. We have 406,70,000 traditional ploughs and 73 million bullocks. We require 8.13 million bullocks to power 4.06 million ploughs. We are already short of bullocks without the slaughtering of these animal for beef export.
6. To maintain the soil fertility, transport, draught and other requirements, we require 630 million cattle against the present available 170 million.
7. Our food grain import goes on increasing.

8. We require 40 million tons of chemical fertilizer per year transport costs etc. The capital cost are gigantic. Instead why not feed the indigenous cows, though poor in milk yield and get in return milk and its products, manures end bullocks from them?
9. Cow dung ash is a good preserver of food grains; cow/bullock hide is a good water lifter in the wellbased irrigation.
10. Transport of food grains to market is done by bullocks.
11. Cow dung cakes and gobar gas plants provide the fuel.
12. Eating agro-waste as fodder, cows recycle the manure.

*Over 80 million draught animals in India today, most of which are bovines, provide 66% of the total agricultural power used, while 23% comes from human muscle power, fossil fuel powered machines (tractors, pumps, etc.) contribute only 11%. It should not be difficult, therefore, to replace this minor quantity of non-renewable energy with muscle power.*

*It is estimated that there are still about 20 million bullock carts with 25 million people depending on them for their sustenance, generating earnings of about Rs. 2000 crore. They carry around 50 million tonnes of goods annually, against 200 million tonnes*



*Music should continue*

*of goods hauled by other modes of transport.*

*This saves about 6 million litres of petroleum fuel per year, valued at about Rs 4000 crore. The use of more animal-drawn transport will also eliminate the intense pollution produced by fossil fuelled vehicles which directly reduced agricultural production.*

*It may seem from the above figures that the number of carts and draught animals for them will have to be increased four times to carry the 200 million tonnes of goods that are now being transported using fossil fuels.*

**Winin Pereira.**

# ENVIRONMENT AND SUSTAINABLE AGRICULTURAL DEVELOPMENT: CONFLICTS AND CONTRADICTIONS

## STATUS AND PROCESS OF SUSTAINABLE AGRICULTURE

| Fragile resource regions  | Well-endowed resource regions   |
|---|---|
| <b>PHYSICAL ENVIRONMENT</b>   |   |
| <ul style="list-style-type: none"> <li>a) Harsh climatic conditions.</li> <li>b) Degraded soils and desertification.</li> <li>c) Depleting natural resources like forests, groundwater and other common property resources due to population pressure.</li> <li>d) Lack of vegetation and in situ moisture.</li> <li>e) Low input intensity in agriculture production and limited protective irrigation facilities.</li> </ul>  | <ul style="list-style-type: none"> <li>a) Favourable climatic conditions.</li> <li>b) High intensive or non-organic input-use.</li> <li>c) High irrigation or cropping intensities.</li> <li>d) Increasing waterlogging and salinity.</li> <li>e) Declining soil fertility.</li> <li>f) Increasing health hazards.</li> <li>g) Depletion of natural resources like forests and other CPRs due to commercialisation of agriculture.</li> </ul> |
| <b>ECONOMIC ENVIRONMENT</b>   |   |
| <ul style="list-style-type: none"> <li>a) Subsistence agriculture (largely) and low value crops.</li> <li>b) Low and stagnant or moderate growth rates in production marketable.</li> <li>c) High level of un / under-employment</li> <li>d) High dependence of non-market sources of income like forests and CPRs.</li> <li>e) Low resource base of the rural community.</li> <li>f) Product and factor market imperfections.</li> <li>g) Low marketable surplus and low profits.</li> <li>h) Larger efforts and expenditure in acquiring basic needs like drinking water, fuelwood, etc.</li> <li>i) Low levels of living standards.</li> </ul> | <ul style="list-style-type: none"> <li>a) Commercial and high value monocrop agriculture.</li> <li>b) High but stagnant / moderate growth in production.</li> <li>c) Multiple choices of income.</li> <li>d) Improved product and factor markets with larger surpluses.</li> <li>e) Easier access to basic needs like drinking water, literacy, health, etc.</li> <li>f) Fairly high levels of living standards.</li> </ul>                   |

### **SOCIAL ENVIRONMENT**

- |   |  |
|---|--|
| a) Low level of social consumption (literacy, health, sanitation, drinking water, etc). | a) Better political awareness and access to social consumption items.  |
| b) Strong cultural values which are often linked to environmental factors.              | b) Greater dependence on technology and hence lesser concern for environment.  |
| c) General attitude is towards resource conservation mainly due to scarce conditions.   | c) Highly commercial mindedness and abuse of natural resources and often compete among themselves in exploiting the natural resources. |
| d) Low level of political awareness.  | d) Priority for accumulation in the short run.   |
| e) Priority for survival in the short run.  |  |

### **POLICY ENVIRONMENT**

- |   |   |
|---|---|
| a) Neglected and half-hearted attempts of development.  | a) Pampered by the policy-makers so far.  |
| b) Lopsided development policies with inappropriate technologies, blanket policies, etc.  | b) Policies are not conducive for natural resources conservation. They are productivity - based rather than being sustainable.                                |
| c) Neglect of natural resource base and alienation of local institutions like participatory process, community management, etc and local knowledge.   | c) Policy-makers fail to utilise the commercial attitude of the people for promoting sustainable policies due to political pressures and rent seeking nature. |
| d) Attitudes among policy-makers are not conducive to the evolution of strategies based on conservation oriented technology, use of local and often, degraded resources and mobilisation of the people. |   |
| e) However, of late, there is a realisation among policy-makers that development of these regions is crucial for sustained overall growth.  |   |

### **LEVEL AND PROCESS OF SUSTAINABILITY**

- |  |   |
|--|---|
| a) Some of the regions are at the bottom of the sustainability curve (SC). | a) These regions are located at all the three points, a, b and c on SC. |
|--|---|



- b) Some on the upward sloping portion of SC.
  - c) As the potential for dry land technology, and market environment in quite high in in these regions, there is a possibility of sustained growth.
  - d) Appropriate policies in terms of technologies and institutions are needed in order to sustain the upward climb of SC curve along with generating awareness through formal education.
- b) The downward trend has become conspicuous in the 1980s.
- b) The vital ingredients for sustainability these regions are, generating awareness through formal education fostered with policies based on market valuation of natural resources. Aggressive market-oriented policies can be pursued much adverse impact.

**From: *The Challenge of the Balance*, Edited by Anil Agarwal, Centre for Science and Environment, New Delhi, 1997.**

*A Parsi farmer in Surat wrote in 1829, that blackgram could provide a good manure for sugarcane, removing the "exhaustion of the soil". Urid was sown in the sugarcane field and ploughed in when the plant was about 30cm tall.*

*Today, the situation is different. The cultivated crops in India remove annually, on an average, 3 million tonnes of nitrogen, 1.5 million tonnes of phosphorus oxide and 3.5 million tonnes of potash. The plant food returned to the soil through organic*



*sources is just about 1.8 million tonnes of nitrogen, 0.60 million tonnes of phosphorus oxide and 1.8 million tonnes of potash. Even allowing for the biological and other natural processes of nutrient production, the balance appears tremendous. But more nutrients will be available as farmers switch back to traditional farming, using longstemmed varieties, rotations with pulses/ draught power and so on. It should be noted that globally, the nitrogen fixed by a diverse group of soil bacteria is estimated at 140 million tonnes per year of which about 90 million tonnes are available for crops, while that added by all the synthetic fertilizers used today is only 40 million tonnes per year.*

## **RESOURCE CONSERVATION TECHNOLOGIES AND PROCESSES**

**JULES N. PRETTY**

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### **I. Functions of Resource Conserving Technologies**

- (a) They conserve the existing on farm resources such as Nutrients, predators, water or soil.
- (b) They introduce new elements into the farming system and add more of these resources such as, i) N fixing crops, ii) water harvesting structures, iii) new predators, iv) produce substitutes or additions.
- (c) Many individual technologies are multifunctional bringing about favourable changes at various levels. But farmers cannot just give up the present use of external inputs. They should substitute labour, skill and learned knowledge and management skills. Farmers should learn, learn to diversify and to use diversity. Greater diversity of practices and technological options.

### **II. Integrated Pest Management (IPM)**

Integrated Pest Management (IPM) combines a range of pest control strategies that reduces pest population and at the same time is sustainable and nonpolluting. It is not merely spraying pesticides, making use of resistant varieties and breeds, locating alternative natural pests, using bacterial and viral products, using pheromones for reducing the impact of pests. Predators and parasites are encouraged by

a)direct releases,

b)improving their physical habitat,



**Adopt resource  
conservation  
technologies  
and processes  
for sustainable  
agriculture.**

- c) increasing farm diversity and
- d) adopting multiple cropping and rotations.

### III. Integrated Plant Nutrition (IPN)

Integrated Plant Nutrition (IPN) involves (a) more efficient use of fertilizers and (b) adoption of alternative sources of Nutrients such as (i) livestock manures, (ii) composts, (iii) legumes, (iv) green manures, (v) azolla and (vi) agroforestry.

### IV. Soil Conservation

This can be enhanced through the use of a) conservation tillage, b) contour farming, c) physical structures, d) mulches and cover crops, e) silt traps, f) gully fields. Many of them have been traditionally used for centuries.

### V. Water Management Systems

They ensure the efficient use of available water. Water conservation and harvesting can improve agricultural yields in dry areas. Where too much water has been used, resulting in water logging and salinization, land drainage technologies making use of collective action can be used. In very wet environments integrated system with a) aqua culture, b) livestock, c) trees and d) crop production can be efficient and productive. These conserving

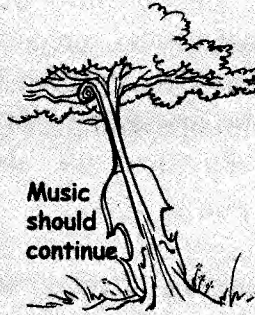
technologies to be fully effective should be adapted by the whole communities.

## SUSTAINABLE AGRICULTURE AND SOCIAL ORGANISATIONS AND INSTITUTIONS

### I. Development is a Collective Affair

Productive and sustainable agricultural operations should go beyond mere agricultural ethos; they should succeed in carrying the whole community with them. More than any other human enterprise agriculture is a

*Azolla is a nitrogen fixing aquatic fern which is an efficient supplier of nitrogen to the rice field for low-cost rice production. It is a renewable biofertiliser. When inoculated in a particular rice growing area, it survives for a long period through its spores, regenerates and spreads naturally. It is an ecological advantage for Azolla in wetland rice field ecosystem for their survival and subsequent development.*



Music  
should  
continue

collective human endeavour, capable of cutting the loose stranded individuals into a meaningfully working community. Full participation and collective action of the individuals are essential. Merely action by motivated individuals won't do.

## **II. Save Local Institutions**

National and international actions cannot substitute local action. They tend to smother the local initiative, destroy local institutions, wiping the latter out. This degrades the environment further and reduces the capacity of the local people in managing environmental change and economic development.

## **III. Local Interest Sustains Work**

People who are already well organized, and those who organise themselves into groups to run the projects stay together after the specific project is completed. The activities are also continued.

## **IV. A slow moving deliberate process of organising people for a project waits for people to accept and own the programme.**

- a) Outsiders should act as catalysts and facilitators ready to withdraw at the appropriate time.

- b) The capacity of the local people should be built up.
- c) Rural people should get direct economic benefits; natural resources should be improved.
- d) Social cohesion and solidarity should be built up.
- e) The confidence of local people grows with success groups evolving newer roles, and joining other groups to achieve wider impact.
- f) Scaling up of local effort to national level should be achieved. Local groups should not substitute local governments but should act as partners. External institutions should act as enabling institutions.

## **WHY COLLECTIVE EFFORTS FOR SUSTAINABLE AGRICULTURE?**

1. One farmer encourages predator through farm habitat management; but on neighbouring farm non-selective pesticides which kill predators are used preventing predators population reaching viable size.
2. Crop rotations, mosaic patterns as part of IPM should involve neighbours

- 
- |  |  |
|--|--|
| <p>to keep pest populations below threshold values, and not to permit the development localised resistance to pesticides.</p> <p>3. For uniformly high landscape value, neighbours also should keep trees, hedges and ponds.</p> <p>4. All the neighbours should have common programme towards social causes, e.g. public road, access etc.</p> <p>5. Ground water contamination, leaching of N or manures have to be met as a common challenge over a larger domain and not by individual farmers.</p> <p>6. Maintaining the purity and cleanliness of surface water free from livestock waste etc is possible only when the community acts in unison.</p> <p>7. Traditional seeds can be multiplied only by a community acting in concert.</p> | <p>(iii) Getting new access to productive resources.</p> <p>(iv) Securing sustainability in the use of natural resources.</p> <p>(v) Providing social infrastructure at village level.</p> <p>(vi) Influencing policy institutions that affect them.</p> <p>(vii) Linking farmers to research/extension services.</p> <p>(viii) Improving flow of information to Govt. NGO's</p> <p>(xi) Organising people to use their own knowledge.</p> <p>(x) catering to the needs of special groups.</p> |
|--|--|

### The Challenge of Intervention

- |   |  |
|---|--|
| <p><b>FUNCTIONS OF LOCAL ORGANIZATIONS AND INSTITUTIONS</b></p> <p style="text-align: center;">For</p> <p>(i) Organizing labour resources for producing more.</p> <p>(ii) Mobilizing material and financial resources credit, savings, marketing.</p> | <p>a) To establish self-reliant groups use organic processes. Don't force, don't speed up.</p> <p>b) Essential elements of self-supporting farmer's organization.</p> <p style="padding-left: 20px;">(i) Developing a financing capacity with own resources.</p> <p style="padding-left: 20px;">(ii) Developing a self-governing</p> |
|---|--|
-

- structure.
- (iii) Gaining recognition among farmers.
- (iv) Developing self-reliance in planning, management and servicing.
- c) The intervening group should act carefully.
- (i) Acting as catalysts, organizers, animators, motivators.
- (ii) Starting with informal organisation.
- (iii) Evolving a formal structure later.
- (iv) Mobilizing acceptable leadership working through consensus.
- (v) Forming a smaller core.
- (vi) Problem solving through prioritizing, self evaluation, action, learning through mistakes.
- (vii) Starting with limited number of tasks.
- (viii) Providing for horizontal diffusion.

### **WHAT CAN A LOCAL GROUP DO?**

A forest protection committee in M.P. could save trees by limiting grazing area, protect trees by stopping felling, persuade others for selling off goats, stopping sale of firewood.

### **INDICATORS OF IMPROVEMENTS IN SUSTAINABILITY**

- 1) Financial benefits.
- 2) Beauty of the prospects.
- 3) Substantial environmental improvements with stable/lower yields in industrialised countries.
- 4) Stable or higher yields with environmental benefits in Green Revolution Lands.
- 5) Increased agro yields in complex and diverse lands based on locally available resources.
- 6) Mixed organic farms with rotations.
- 7) Mixed livestock - ridge tillage - rotations.
- 8) Weed harvesting.
- 9) Multiple cropping.
- 10) Conservation tillage.
- 11) Organic manuring.
- 12) Intercropping.
- 13) Reduction of fungicide use.
- 14) Low input pesticide.
- 15) Integrated farming.
- 16) Bio-dynamic farms.
- 17) Organic farms.
- 18) Better quality of products, better taste.
- 19) More diverse and wildlife rich landscapes.
- 20) Maintenance of environmental quality uncontaminated aquifers/surface water.
- 21) Sustaining of resources for future generations.

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- 22) Increased wild bird populations and numbers of territories.
- 23) Reduced soil erosion.
- 24) Increased number of beneficial insects.
- 25) Lower livestock stocking rates.
- 26) Improvements in animal welfare—less drugs.
- 27) Fish culture.
- 28) Integrated Pest Management.
- 29) Waste recycling.
- 30) Compost.
- 31) Rice-fish culture.
- 32) Agroforestry.
- 33) Green manures.
- 34) Trenching.
- 35) Resistant varieties.
- 36) Rearing predators.
- 37) Irrigation improvement.
- 38) Cutting external inputs.
- 39) Substituting knowledge, labour management skills for external inputs.
- 40) Development of niche markets for organic farm products.
- 41) Community benefits.
- 42) Soil/water conservation.
- 43) Land rehabilitation.
- 44) Nutrient conservation.
- 45) Better community cohesion.

**What kind of policy support can help Agricultural Sustainability ?**

- a) Market price support, b) Direct payment to farmers - food for work, c) Input cost reduction, d) Provision

of general services - research, extension, e) Other indirect support - regional, crop specific.

**WHAT CAN LAW DO TO SUPPORT AGRO-SUSTAINABILITY**

- 1) Declare illegal cultivation of certain types of Land, (i) steep slopes, (ii) land by river banks, (iii) govt. land, (iv) forest land.
- 2) Ban the use of certain pesticides.
- 3) Prevent residue accumulation by preventing spray just before harvest.
- 4) Restrict the use of antibiotics, growth regulators to livestock.
- 5) Stop felling trees.
- 6) Establish upper limits for animal stocking densities.
- 7) Certify crop varieties before allowing farmers to use them.
- 8) Establish standards/limits for foodstuff contamination/drinking water.
- 9) Land reform-farm size, land tenure laws.

**GENERAL SCENARIO OF POLICY PROBLEMS IN SUSTAINABLE AGRICULTURE**

- 1) Success in Sustainable Agriculture is in limited areas only.
- 2) Most policy support is for encouraging agriculture that dependent on external



- inputs, technology, knowledge.
- 3) The present policy measures are disincentives to sustainability.
  - 4) There is no support for farmers in bearing the transition costs while switching over to Sustainable Agriculture from high input Agriculture.
  - 5) Policies do not reflect long term costs of modern farming—soil erosion, health damage, polluted, eco-systems.
  - 6) No encouragement to integrated, alternate practices.
  - 7) The policies are incoherent/piecemeal.

### **POLICIES NEEDED TO PROMOTE SUSTAINABLE AGRICULTURE**

- 1) Declare a National policy for Sustainable Agriculture.
- 2) Encourage Resource conserving Technologies/practices.
  - a) National strategy for Integrated Pest Management.
  - b) Priority for research in Sustainable Agriculture.
  - c) Property right for farmers.
  - d) Promotion of farmer to farmer exchange.
  - e) Direct transitory support for farmers.
  - f) Subsidies/Grants for Sustainable Technologies.
  - g) Support payments to be linked to Resource conservation.

- h) Appropriate prices with taxes-levies penalize polluters.
  - i) Better information for consumers/public.
  - j) Natural Resource Accounting.
  - k) Standards / Regulations for pesticides.
- 3) Support local community action. Local groups, rural partnerships, training programmes incentives for on-farm employment, local responsibility for conservation, group-credit.
- 4) Change external enabling institutions participatory methods, research and extension, project as a learning process not as a blueprint, strengthening NGO to scale up better NGO-Govt. partnerships, better conflict resolution and mediation techniques.

### **STAGNATION IN MODERN SYSTEMS**

For many years, many farmers, many economies, high input agriculture will continue to be important. But potential for further improvement and Sustainability is uncertain.

Compared to 1965-80, in Green Revolution countries annual growth rates in agricultural sector has fallen.

Agricultural projects in general are faring poorly. Donors turn away from Agriculture.

Cereal yields are not sustainable.

Mono cropped cereals yields dwindle over years. To maintain yields, in some cases, the fertilizer application had to be increased by 50%.

### REASON?

Pests, diseases, chemical toxicity, changing soil C-N ratios, chemical deficiencies changed micro environment.

Input need increases for maintaining yield declining profitability.

“Degradation of paddy environment by micro nutrient depletion, atmospheric pollution, pest pressure accumulative toxic

change in soil chemistry has played havoc. It is greater than the capacity for genetic improvements in yield potential that breeders can select”.

May be Nitrogen fixation in roots may come as a breakthrough, and if this reaches the poor, will help.

### WHAT IS NOT SUSTAINABLE AGRICULTURE

1. Modernized Agriculture.
2. Conventional Agriculture.
3. Resource degrading Agriculture.
4. Industrialized Agriculture.
5. Intensive Agriculture.

### AQUACULTURE IN INTEGRATED FARMING SYSTEM

Protein deficiency is the world's most serious human nutritional problem of the day. Fish assumes special importance in meeting part of the protein requirements.

Adaptation of intensive techniques involving higher stocking density, use of aeration devices and integration of dairy, poultry, duck farming, piggery, horticulture, vermiculture and fodder



cultivation with aquaculture for recycling wastes within the farm would help enhance the unit area production of fish. Integrated farming systems generate more income to the farming community. Integrated farms with focus on composite fish culture and fish polyculture in appropriate stocking densities draw their major nourishment from recycled organic wastes from an integrated livestock unit. This would help enhance the unit area production and generate more income to the farming community.

6. High External input Agriculture.
7. It does not "go backward".
8. It is not incompatible with existing methods.
9. It is not subsidy supported.

### WHAT IS SUSTAINABLE AGRICULTURE

1. Alternative
2. Regenerative
3. Low external input
4. Low input Sustainable Agriculture
5. Resource conserving
6. Biological
7. Balanced inputs Sustainable Agriculture
8. Natural
9. Ecoagriculture
10. Agro-ecological
11. Organic
12. Biodynamic
13. Permaculture are other names used for Sustainable Agriculture.

Resource conserving low input, regenerative agriculture is SUSTAINABLE AGRICULTURE. It uses local knowledge and local resources.

Organic Agri is a form of Sustainable Agriculture though not all Sustainable Agriculture is Organic.

### SOCIAL CONSTRUCT OF SUSTAINABILITY

Attempts to define sustainability miss the point that like beauty, Sustain-



**Sustainability is in the eye of the beholder.**

ability is in the eye of the beholder. It is inevitable that assessments of relative sustainability are socially constructed which is why there are so many definitions — *Andrew Campbell*.

At the farm/community level it is possible for actors to weigh up, trade off and agree on the criteria for measuring trends in Sustainability. Sustainability is more a process of learning as you go along.

**Extracts from : *Regenerating Agriculture*, Jules N. Pretty, Vikas Publishing House Pvt. Ltd., New Delhi, 1995.**

## **WATER, FLOOD, DAMS, TANKS AND GROUNDWATER**

**Ostrich :** Water has become a problem everywhere. Mineral water sells in bottles telling every one that the society has lost hope of getting potable water to the common man. In Gujarat and Rajasthan what were drought control departments two months ago are now changed into flood control centres. We do not know whether the problem is excess of water as in floods or shortage of water as in droughts.

**Swan :** Water management is the problem. The physical bodies of all living beings including human beings are made up mostly of water and life thrives in water. Water has a number of properties such as the capacity to flow, cool, dissolve chemicals and air etc. Water can evaporate quickly, warm up fast. It is transparent. Each quality of water can evaporate quickly, warm up fast. It is transparent. Each quality of water can be put to use without water being degraded in other respects. You can put the same quantity of water for as many as fifty uses “recycling it”. Still man is able to use only 9.5% of all water available on earth allowing 90.5% to go waste.

**Parrot :** Then why do people object when Governments build big dams to save water and direct its flow to the needy areas.

**Swan :** Dams are not necessarily the most economic way of harvesting water. They are situated far away from areas where water is used. Dams destroy forests, uproot people, silt up earlier than expected time. Many of the dams could have been replaced by smaller lakes, ponds, etc as it has been done in Chingelpattu, Pudukkottai and Ramanathapuram districts of Tamil Nadu. Efficient water harvesting methods store water where it falls as rain and where it is used by people. Such water collection can be done by the people by their labour with the help of simple tools. Major dams may be unavoidable in certain cases.

**Parrot :** Then why do agitators raise so much noise against them?

**Swan :** These agitators do not have a large following. They do not go to the people, teach them to harvest water locally and render big dams unnecessary. This sort of constructive work has not become popular.

It does not have as much advertisement-value as opposing a huge dam being erected. These anti-dam people wait until the government is driven by water shortage to build big dams and then protest.



Dams are scientific. Lakes and ponds are traditional.

**Ostrich :** How are we going to manage floods?

**Swan :** We have to learn to live with Himalayan floods where the mountains are growing, soil is loose and rainfall is high. Floods are unavoidable there. In other areas floods can be managed by prevention of soil erosion and avoiding deforestation and regular cleaning of waterways. All in all, floods cause temporary inconvenience to farmers but reward them with rich silt deposits. Man should stop meddling with the earth's climate, rain cycle, rain predictability etc. There are global problems, which have tremendous local impact.

**Ostrich:** Dams are scientific. Lakes and ponds are traditional.

**Swan :** But dams are uneconomical. Small check dams can be constructed with locally available material by local users. Since check dams and bunds are of immediate local application, farmers may not grudge contributing labour for their upkeep. Big dams never host big fish schools or after economic fish catches. Local water bodies, are decentralised water, wells, hand pump etc., with them transmission losses are minimal and they produce fish in large quantities. Inland fresh water fish is an important source of protein for villagers.

**Parrot :** What about ground water? It is good source of income in cities!

**Swan :** Ground water is being over-exploited, pushing the water table levels



Ground water is being over-exploited, pushing the water table levels deep down.

deep down. As a result, wells dry up. Shallow wells become uneconomical. Recharge rates are low. Eventually wells and pumps dry up.

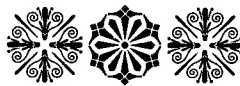
**Ostrich :** In the meanwhile electricity for agriculture has become a scarce input, its supply and timing becoming unpredictable.

**Swan :** All over the world there is a growing feeling, subsidising electric supply for pumping water for agriculture has permitted farmers to misuse the facility,

overdrawing ground water, over irrigating farms.

**Parrot:** Over irrigating? After all agriculture is a field operation. You can not use a burette and pipette for dropping water to a plant!

**Swan :** Over irrigation has pushed the nutrients dissolved in water far down below, beyond the reach of the roots of the plants, literally starving them. Where water is economically used as in sprinkler irrigation systems, agriculture yield has been better.



## WATER

**I**n 1984 India used 10% of its rainfall it receives annually. In 2024 it will use only 25%. Proper storing of water, using water without polluting it are arts India should learn. Otherwise there will be serious water shortage.

India's groundwater resources are ten times its rainfall. Every year nearly 1.75 lakhs of tubewells are added. The water table is declining steeply everywhere. The dug wells of the poor are left dry.

Tanks, the most popular mode of cheap, *in situ* and consumer-friendly way of water storage system in ancient India. In the British and Free India regimes, tanks were neglected, inlets were cut off. Tanks got silted up, converted into housing plots or sewage tanks. A century ago tanks irrigated half the cropped area in India. Now tank irrigation is 10% of the cropped area. Experts calculate that tanks built over 3% of India's land area could store a quarter of its rainfall.

All high altitude lakes of India, including the famed Dal lake of Kashmir are dying of

pollution. The sufferers include fishermen, water consumers, irrigators, tourists, tourism-workers etc.

We are slow in understanding the ecological value of wetlands. Calcutta's Salt Lake city built on vast wetlands, has blocked the city drainage. Calcutta has lost its supply of fresh water fish, its favourite food.

Rivers and lakes get more and more polluted. Large dams are seriously affecting riverine fisheries.

Fisherfolk used to fish near home are now driven far away in search of their catch. Millions of people travel hundreds of miles for scores of days for fishing a livelihood.

Dam waters cover 1% of India's land area. They produce little fish. Nor do they give employment to fishermen. The best yield of fish from a reservoir has stood at 190 kg a hectare. The best pond has produced 8000 kg fish per hectare.

Spurt of aquaculture, as a part of industry has caused pollution over

thousands of hectares of rice producing wetlands in coastal Andhra and Central Eastern Tamil Nadu.

Factors affecting water scenarios are (1) Poor storage facilities (2) Wasting away of existing capacities (3) Deforestation (4) Neglecting soil conservation (5) Weakening community bonds with their responsibilities towards tanks, canals (6) Government's preference for large dams against small ponds (7) Floods and droughts in endless cycles (8) Poor documentation (9) Pollution of water bodies (10) Large scale pumping of groundwater leading to the decline of water table (11) Covering up the aquifer surface resulting in poor recharging of groundwater.

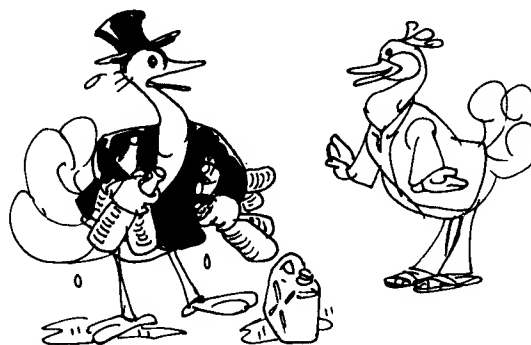
Growing urbanisation has resulted in producing more sewage with poor disposal facilities. Rivers are the 'natural' outlets. Most Indian rivers have toxic drains. Industrialization adds to the pollution of rivers. Ganga receive 900 million litres of waste water per day. Sabarmati, the small river gets 1000 million litres of Ahmedabad's sewage water.

Over extraction of river water for cities, irrigation etc leave rivers dry. The pollutants do not get diluted e.g. Yamuna in Haryana.

Traces of fertilizers and pesticides from fields are found in river waters. The levels

have crossed permissible limits. Govt. attempts to save rivers have failed.

A kind of water emergency exists. Oil spill pollution, frequent closure of drinking water purification plants are signs of the



The growing mineral water, spring water or bottled water industry is a covert acknowledgement of the failure of the system to supply safe drinking water to the common man.

times. The growing "mineral water" "bottled water" "pure water" "spring water" industry is a covert acknowledgement of the failure of the system to supply safe drinking water to the common man.

Dirty water kills. It kills the weakest and the defenceless children at the rate of one million per year through diarrhoea and other stomach disorders.

Rivers that have crossed the danger mark in pollution include, Damodar (Bihar), Betwa (Madhya Pradesh), Yamuna (Delhi).

The ways by which the pollution enters the river are (1) Industrial pollution (2) Domestic waste from urban centres



(3) Dumping of carcasses in the rivers (4) Over extraction of water (5) Agricultural run off adding micro pollutants (6) Deforestation and mineral exploitation (7) Mining of atomic minerals (8) Absence of groundwater recharge (9) Deforestation of catchment areas.

**Water Balance: Current Status**

|  |         |     |
|--|---------|-----|
| Present utilizable fresh water Resources | 110-112 | MHM |
| Currently used fresh water Resources     | 53      | MHM |

**Renewable water sources:**

|                                      |     |     |
|--------------------------------------|-----|-----|
| Average rainfall                     | 400 | MHM |
| Rainfall available as surface water  | 185 | MHM |
| Rainfall that can be stored as gw.   | 50  | MHM |
| Rainfall which can be stored in soil | 165 | MHM |

**River Basin flows**

|   |          |             |
|---|----------|-------------|
| Average annual run off                          | 1853.494 | (cubic kms) |
| Estimated utilizable flow excluding groundwater | 690.309  | (cubic kms) |

**Groundwater in India (million hectare metres)**

|                                       |         |     |
|---------------------------------------|---------|-----|
| 1) Replenishable groundwater Resource | 43.19   | MHM |
| 2) Domestic industrial other uses     | 7.1     | MHM |
| 3) Available for irrigation           | 36.1    | MHM |
| 4) Groundwater extraction (gross)     | 16.45   | MHM |
| 5) Groundwater extraction (net)       | 11.52   | MHM |
| 6) Balance groundwater for future use | 24.58   | MHM |
| 7) Level of groundwater development   | 31.02 % |     |

Note : MHM = Million Hectare Meters.

**Use of water in 2000 (needed)**

|                    |             |   |
|--------------------|-------------|---|
| Population         | 1000        | Millions  |
| Irrigation         | 63          | MHM needed (42 million hectare meters, surface water, 21 MHM groundwater) |
| Domestic/livestock | 3.4         | MHM water needed  |
| Industry           | 3.6         | MHM water needed  |
| Thermal power      | <u>5.00</u> | MHM water needed  |
| Total              | <u>75.0</u> | MHM water needed  |

**IRRIGATION**

|  |                       |   |                             |     |
|--|-----------------------|---|-----------------------------|-----|
| Total irrigated area 1992-93                 |                       | Wheat 31.2%   | Potential created 93-94     | 68% |
| 66,144 thousand hectares                     | (100%)                | Others 9.10 %   | of which potential utilised | 89% |
| Foodgrains                                   | (70%)                 | Ultimate potential of Groundwater potential of India 64,040 thousand hectare. |                             |     |
| Oil seeds                                    | (9.6%)                | Percentage of potential created up to 93-94 :                                 |                             | 65% |
| Sugarcane                                    | (5.5%)                | of which utilised percentage :  |                             | 93% |
| Condiments/spices                            | (2%)                  | India Net area irrigated by mode of irrigation 1992-93                        |                             |     |
| Fruits, vegetables                           | (2%)                  |   |                             |     |
| Groundnut                                    | (2.5%)                |   |                             |     |
| Rapeseed/mustard                             | (5%)                  |   |                             |     |
| Cotton                                       | (4.00%)               |   |                             |     |
| Tobacco                                      | (0.3%)                |   |                             |     |
| Others                                       | <u>(4.5%)</u>         |   |                             |     |
| Total (66,144) thousand hectare metres 100%. |                       | Canal-Govt - 16.6 million hectare   |                             |     |
|  |                       | Private - 0.5 million hectare   |                             |     |
|  |                       | Total 17.1 million hectare  |                             |     |
| Of the 70%                                   | Ultimate potential of | Tank - 3.3 million hectare  |                             |     |
| Foodgrains                                   | minor irrigation in   | Well - Tubewell -15.8 million hectare   |                             |     |
|  | India (Surface water) | Others - 10.7 million hectare   |                             |     |
|  | in thousand hectares  | Total 26.5 million hectare  |                             |     |
| Rice 29.7%                                   | 17,378.00 thousand    | Other sources : <u>3.3 million hectare</u>                                    |                             |     |
|  | hectares              | Total <u>50.2 million hectare</u>   |                             |     |

# GROUNDWATER MANAGEMENT IN INDIA

**TUSHAAR SHAH**  
*Institute of Rural Management*  
*Anand*

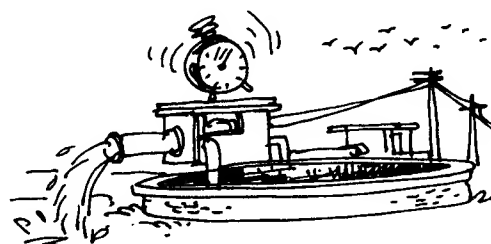
India has a very long tradition of groundwater irrigation. However, the problem of groundwater management has become a major issue only in the recent years. To understand why it has become such a problem, we must look at the interplay between economics and environment.

Farmers have traditionally been using wells for irrigation. 'In the traditional systems where animal and human labour was used to lift water from wells and transport it to the fields, the safe limit of groundwater development was not crossed. With the onset of Green Revolution, the technology used changed the production function with respect to water in a fundamental manner. The water-lifting technology changed drastically.

With the introduction of diesel engines and electric motor-based lifting devices, the



India has a very long tradition of groundwater irrigation...



Capacity of the farmer to draw water per unit of time increased manifold.

capacity of the farmer to draw water per unit of time increased manifold. It became very profitable for the farmer to use a much higher level of water per unit of land. This made the propagation of the Green Revolution technology possible in all areas where groundwater irrigation had a high potential.

At the same time, we need to pay attention to areas which face water scarcity as well as areas both where there is excessive groundwater, just below the ground surface. In the latter areas, drawing groundwater is doing a service to the community and to the ecology. In other areas like North Gujarat or Coimbatore, where we are very rapidly reaching the safe levels of water withdrawal, the social cost of using groundwater would be very different.

In 1951, when modern water extraction technology was relatively new, we had less than 5,000 public tubewells, and less than 100,000 modern water extraction mechanisms which used either diesel engines or electric motors. Today, we have 67,000 public tubewells (which are tapering off only because nobody sees any advantage in setting them up) and nearly 13 million to 14 million private water extraction mechanisms, which are growing at a rate of a million every year.

The other major factor which exerts immense pressure on groundwater, is the fact that as irrigation has become increasingly central to Indian agriculture, farmers have begun to implicitly differentiate between different types of irrigation systems. They have begun to look at irrigation as a service. In such a situation, groundwater has a decisive advantage over other irrigation sources.

A number of studies have shown that among different sources of irrigation, including tanks, canals, public tubewells, buying water from private water tubewells, etc. the irrigation surplus that is generated through efficient use of water tends to rise stupendously as we move from rainfed agriculture to tanks, canals, public tubewells, buying water from private tubewells, or individual tubewells. As we move from rainfed irrigation to own tubewells, the cost of cultivation goes up, the cost of

irrigation also tends to go up, but the value of gross output per acre tends to go up at a much faster pace than all of these. We know that in case of purchased tubewell water, the cost of irrigation is the highest. If you have your own tubewell, the cost tends to go down a little, but the net irrigation surplus tends to increase uniformly as you move from rainfed irrigation to own tubewells. This is primarily due to the better quality of irrigation service that is provided by private tubewells and private water markets which offer irrigation service on demand.

### WATER MARKETS

Let me here also refer to the prevalent institution of water markets. A good deal of research suggests that trading in water is pervasive, that it is important to people who own tubewells or water extraction structures and people who depend on them. Water markets are village-level markets, and are fragmented, informal and seasonal. In states like Gujarat, where they are very extensive, 30 to 60 per cent of the water that is pumped out is sold to other farmers. In Kheda district where I work, 90 to 95 per cent of the water produced by an average tubewell owner is for sale. Thus, owners of lifting structures use the opportunity to sell water to their neighbours as a way of increasing the capacity utilisation of their tubewell and reducing the average

pumping cost. Terms on which this water is sold vary.

The institution of water markets leads to high utilisation of investments in wells and pumps at both the societal level as well as at the level of individual tubewell owners. This also broadens poor people's access to groundwater as they are typically the buyers of water as they cannot afford to have their own structures. Such markets also overcome the constraints imposed by land fragmentation, enhance labour demand and spread it evenly over the year.

Moreover, in Gujarat, such a situation has stimulated massive private investments in pipelines which, in turn, have led to greater efficiency in the use of water. But at the same time, water markets also result in larger withdrawals of groundwater than would be the case under autocracy. If there were no water markets, less water would be pumped. Water markets tend to be underdeveloped or nonexistent in those areas which either have too much water or which have too little water.

Therefore, basically, tubewells offer irrigation service on demand. And it is precisely because of the greater control over timing and quantum of water supplied, that groundwater irrigation has become very popular, even in areas where there may be other sources of irrigation.

At the national level, the Central Ground Water Board (CGWB) and the National Bank for Agriculture and Rural Development (NABARD) study the state of groundwater supplies. In the mid-1970s, the estimated groundwater availability in our country was around 17 million hectare-metres (mham). As our knowledge about and methodologies for estimating groundwater potential improved, these estimates were revised upwards. In mid-1975, the groundwater potential was estimated at around 30 mham, and the latest estimate given by CGWB is about 45.7 mham. This figure is again due for upward revision.

If we consider how groundwater is used in a state like Gujarat or Maharashtra, where the efficiency of water-use is fairly high, then 45 mham of groundwater should be able to irrigate around 70 million to 75 million hectares of land.

While 45 mham is a fairly large groundwater potential, considering the rate at which groundwater is being developed and appropriated, in another five to seven years, we will have crossed the safe groundwater-use limit. Overexploitation at the national level would have started. Therefore, the problem which is now being viewed as local - concentrated in places like Mehsana in north Gujarat, Coimbatore in Tamil Nadu, etc. - will have assumed national proportions.

According to my own estimate, by the year 2006 or 2007, we could have nearly 30 million private water extraction structures. And, at that level of development, there will be no more groundwater left to be appropriated.

So far there has been no policy framework under which groundwater development has occurred. In fact, the fundamental sense in which groundwater differs from the surface-water sector is that there are no State or Central Government rules governing its usage. The development, appropriation and use of the resource is in the hands of 15 million private pumpers whose behaviour the government can in no way directly control. This is not the case with regard to large irrigation projects where, if the situation so demands, somebody can just switch off the water.

The central problem, therefore, in this sector, is to move from a regime of absolutely no management at the sectoral level to a regime of some sector-level management. There should be some efficiency considerations in the way the resource is being appropriated and used. There should be equity considerations and, above all, we should worry about sustainability.

When you try to operationalise these goals, there are a number of complications.



When one talks about efficiency in ground water usage, there are several types of efficiency that one can refer to. Economic efficiency, for example, itself consists of two or three different concepts. At the national level, efficiency of groundwater development should mean to minimise the social costs of developing groundwater resources. At the local level, it may have a very different meaning. At the same time, there are other inputs whose efficiency is also important. Thus, for instance, energy efficiency in pumping of water is extremely important. Similarly, attention should be paid to the efficient use of water. Most irrigation systems in India and elsewhere use 10 to 15 times more water than what the plants actually need and use. There is, therefore, a great deal of scope for increasing water-use efficiency.

Similarly, when we refer to equity - there are several ways in which equity can be operationalised. Equity between different members of the community, equity between different classes in the same community, equity between different regions - equity issues exist at different levels. Sustainability is another dimension of equity where we look at equity between different generations. We must also be careful that the cost of maintaining sustainability is not borne by one particular section of the society.

What has been done so far to bring order in the groundwater sector is really not much. Official responses have basically been of four types:

1. The earliest initiative in the field of groundwater management was the starting up of public tubewell programmes. The main purpose behind starting these programmes was to get farmers to use groundwater, to promote groundwater irrigation for protective purposes as well as for production purposes. There was also a consideration that access to groundwater should be broad-based. Poor people, resource-poor small farmers should also have access to groundwater. What has been the overall experience with public tubewell programmes in India? My assessment is that they have been a resounding failure. In state after state, the government now wants to transform public tubewells to lift irrigation groups. In Gujarat, for instance, programmes already exist to transform public tubewells into cooperatives.
2. Secondly, sporadic efforts have been made, in different parts of the country, by non-governmental organisations, to evolve different kinds of community organisations who would own and operate lift irrigation systems and tubewells. The main purpose here was to promote equity, to broadbase the existing groundwater. While there have been a number of innovations, if we consider the scale of their impact, it is really very small.
3. The third major intervention has been by NABARD, which has been by far the most powerful form of official intervention. NABARD's credit programme accompanied by the subsidies given under the 'million well' programme, has been the single most important policy lever which has stimulated groundwater activity in Northern India. Together with the state electricity boards and the state groundwater departments,

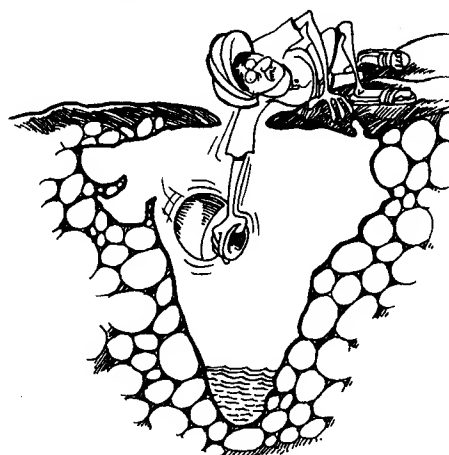
they have created a set of norms in dispensing loans, which are used in many states. It is through these norms that a certain amount of order has been sought to be brought into the way in which groundwater development is occurring at the private initiative.

In Gujarat, for instance, there are specific norms which deal with the distance that has to be left from an existing tubewell before a new tubewell can be sunk. While it is true that if one has the money to use a diesel engine, these norms do not apply. But if one has to go through a nationalised bank or through the Gujarat Electricity Board, then these norms will have to be satisfied. If one cannot satisfy these norms, one is not eligible for an electricity connection or a bank loan. Obviously, these norms have been operating in a very inequitable manner. The norms which came in the 1970s began to be seriously implemented only in the 1980s. People who entered the fray earlier were not affected by these norms.

4. Efforts have been made to frame a groundwater law. In fact, the government of Gujarat even drafted a groundwater bill which has not been

made into a law. But, problems would continue to exist even if a law was framed and passed.

What has been the people's response to the emerging opportunities offered by groundwater? Several new institutions have developed in the countryside which build upon this opportunity or convert it into



livelihood for a number of people. The most pervasive institutional response has been the development of water markets in various parts of the country. Besides this development, there have been instances where groups of resource-poor small farmers, have been trying to come together, so that they can own their own water extraction equipment.

In overall terms, if we consider the policy-making institutional framework in this sector, there are two problems which seem very crucial.



1. There is a complete lack of orchestration. Different bodies are charged with different functions and there is no meeting ground between them - they seldom talk to each other. Not one of them has an overall perspective of what is happening in this sector.
2. Another major problem is serious under-management. There is no one worrying about the overall sectoral-level issues and the overall management of the resource at the national, state, regional and sub-regional level. No appropriate institutions have been developed or policies drawn up which can influence the large number of sectors operating in this system. Added to these, there is no integral perspective of the groundwater sector.

Thus, in systems where traditional water extraction mechanisms are used, we can assume that the water-table is at a stable level. With the introduction of modern water lifting technology, the water demand goes up as each farmer tries to equate incremental private cost with incremental private returns. This leads to a fall in the water-table as a larger amount of groundwater is extracted.

Moreover, with the onset of the Green Revolution, benefits of irrigation are

very high. In such a situation even if a levy or tax is imposed on the farmers with the idea that this will reduce their water demand, it may not have the desired effect.

Similar is the case with canal irrigation where the incremental cost of water-use to the farmer is almost zero. The farmer is induced to use a lot of water, which is the situation prevailing in most command areas. Thus, the ecology-environment problem exists in both the cases.

But, if proper management policies are drawn up at the system level, the water-table can be stabilised. However, this requires appropriate policies to be implemented at the basin level. The kind of policies that should be developed are exactly the reverse of what happens in a typical canal system at present. For example, if we look at any canal system operating at present, we find that the water-table is very high near the head reach, and it falls towards the tail. Added to this, if we consider the canal irrigation supply, it tends to be very high at the head, and low as one moves away. But what needs to happen is exactly the opposite of this.

At the same time, when we look at drain irrigation, where farmers are allowed to irrigate from drainwater, it tends to be

free at the head reaches, whereas it should be charged here. And, at the tail-end, it is not available and one needs to augment the supply of surface-water.

In Gujarat, for instance, there are no public tubewells at the head of most canal systems, where, in fact, they are needed most to provide vertical drainage for canal seepage. But at the tail-end, a number of public tubewells can be found where the groundwater is, in any case, scarce.

Thus, the policies being followed at present are, in fact, exactly opposite of what needs to be implemented. This is where basin-level management becomes an extremely crucial issue where we talk about sustainable groundwater management.

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Edited by Anil Agarwal, Centre for  
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1997.*



## TANKS AND TANK IRRIGATION

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When we talk of traditional water harvesting systems, the tanks and 'eris' of South India immediately come to mind. According to the minor irrigation census, there are nearly a quarter of a million tanks in the country. About half of these, and more than half the area under tank irrigation is located in Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. The tanks are the product of a long period of evolution and adaptation but there has not been any major innovations in the technology, design, materials used, structures, etc or in the way they are managed.

At the time of Independence, according to some estimates, the storage capacity of tanks all over India was estimated at 15 billion cubic metres (bcum). At that time the total storage capacity of the large reservoirs (that is, medium and large dams) was estimated at about 18 bcum. The tanks also irrigated a sizeable area - about 4 million hectares of land, out of a total net irrigated area of some 20 mha.

In the post-Independent period there has hardly been any increase in the

storage capacity of the tanks. On the other hand, the total capacity of large storages, medium and mega-projects, has increased from 18 bcum to 146 bcum by 1970 and an estimated 239 bcum by 1990. The area under tanks and other minor surface sources has, in fact, steadily fallen (from 6.6 mha in 1950-1 to 5.7 mha in 1985-86). The area reported under tank irrigation in South India has also fallen. This raises two kinds of reactions.

1. Without large storages such large quantities of water could not have been impounded to supplement the existing water sources and increase irrigated areas to the extent achieved.
2. The other reaction comes from the ecologically sensitive groups which feel that a fundamentally wrong policy was adopted when we went in for large dams. This group feels that we should have gone in for tanks in a big way because they are cheaper, more amenable to local control and cause less ecological damage.

In assessing these reactions, I will first describe the general features of tank irrigation, primarily in South India and particularly in Tamil Nadu. I will then evaluate some of the arguments about what the role of tanks should be; their place in the water control system; and, the appropriate strategy to bring that about.

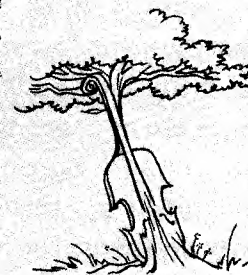
There are basically 2-3 types of tanks. The first is what is referred to as the rainfed isolated tank in a micro-watershed. There is no tank above or below this structure. Whatever rain falls in its catchment is the water which feeds this tank. It has no other source of supply. A more typical situation is that there are a series of tanks formed by impounding or

diverting water flows in streams fed by larger catchments comprising a number of micro-watersheds. A tank at the head of the stream taps the water in its catchment – which is a fraction of the catchment of the entire stream. Then whatever is surplus will flow downstream. This together with rainfall between the catchment of first tank and that of the next will feed the second tank and so on. We then get a chain of tanks. In such a chain there is a certain kind of unidirectional interdependence. The supplies of all downstream tanks will depend on what happens upstream in terms of rainfall, how it is impounded and how it is utilised. The supply characteristics in terms of quantum and the variability of water are strictly determined by the rainfall in the catchment.

*Alexander Walker, Resident at Baroda, wrote (around 1820): "The practice of watering and irrigation is not peculiar to the husbandry of India, but it has probably been carried there to a greater extent, and more laborious ingenuity displayed in it than in any other country. The vast and numerous tanks, reservoirs, and artificial lakes as well as dams of solid masonry in rivers which they constructed.. show the extreme solicitude with which they had to secure this object. These systems*

*need to be rejuvenated with equal ingenuity with which they were initially built and maintained.*

**Music  
should  
continue**



*Over 500,000 of the old tanks still survive to this day. It has been calculated that tanks restored or built over 3% of India's land area could store one quarter of the nation's rainfall.*

This limitation is overcome by the tanks being linked to a large reservoir, or a diversion across the river, fed by a much wider catchment than the particular stream on which the tank happens to be situated. These are referred to as “system tanks”. Having the benefit of tapping rainfall over a much wider catchment area, both the quantum and the assurance of their supply is substantially delinked with the rainfall in the specific catchment of that tank. More so, if the tank is fed by a larger storage. Usually these tanks can store more water, and supply water for a longer duration, with a greater assurance. The distinction between the system and non-system tanks is obviously important. Unfortunately, except in Tamil Nadu, it is not explicitly made in reported statistics.

Typically, most tanks are shallow waterbodies with low storage capacity. In Tamil Nadu and Andhra Pradesh these storages are no more than 4-5 feet deep on an average. Secondly, the ratio of waterspread area - that is, the area which has to be submerged by the storage relative to the area which can be served by the water stored - is close to 1, ranging from 0.7-0.8 to as much as 1:2. In other words, for every acre irrigated by tanks, one acre or more is taken up by storage. This fact assumes relevance in arguments about the economy, ecological and technical feasibility of tanks versus other kinds of storages.

Of the 39,000-40,000 tanks in Tamil Nadu, 20,000 irrigate less than 100 acres and are under the control of *panchayat* unions; nearly 9,000 are under the public works department (PWD), about 4,000 of them being system tanks. Another 10,000 tanks are classified as *zamin* tanks. Most tanks are controlled and managed by the community of irrigators.

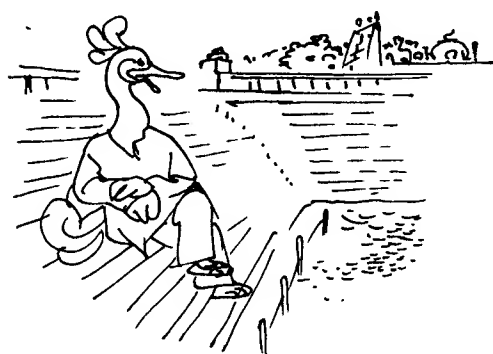
Most tanks serve only a single village or part of it. A typical tank can usually serve only a fraction of the total cultivated area of the village. Many villages have more than one or two such small tanks. Very few tanks are multi-village tanks. In Tamil Nadu there are some tanks which irrigate as many as 15 villages. But such big tanks irrigating 3,000-5,000 *ayacut* area are rare.

There is also a certain congruence between the community which is served by a tank and the community where it is located. This congruence has important consequences. The community of users located in a single village are bound together by a variety of social ties and the management of the tank is embedded in this larger social structure. Management is decentralised with the village community deciding what rules to follow, how to carry out repairs, etc.

The tanks also differ in terms of the number of fillings - that is, if a tank with a capacity of one million cubic metres is

filled only once every year, it can store one million cubic metres of water in the year. But there are tanks which are filled more than once a year. We have also come across small tanks, which are part of larger systems, getting filled as many as 10 times a year. The total volume of water available clearly depends on both the storage capacity and the number of fillings that the tanks get. The revenue department of Tamil Nadu classifies tanks on the basis of both the duration of supply (which has to do with number of fillings) as well as the assurance of supply. The perennial tanks are in the topmost category while rainfed tanks with unreliable seasonal supply fall in the lowest category.

Most tanks have often been constructed by pooling of local efforts – generally by the landholders. In South India, and in Tamil Nadu particularly, the temples have historically played an important role



Temples have historically played an important role in investing their surpluses in the building of tanks.

in investing their surpluses in the building of tanks. The fact that tanks have been constructed by the community means that an implicit agreement exists within that community about sharing the responsibility for the maintenance of facilities as well as the usage and regulation of water in normal times and in times of scarcity.

There is a rich body of traditional practice concerning these matters. Some of it has, in fact, been codified. We have located codified rules called *mamulnamas* dating back almost 200 years for several tanks in the North Arcot district. They essentially set down, in vernacular Tamil, the traditional conventions and rules about who is entitled to what water, which sluice is to be opened, who would be the functionaries, how the water is to be rationed in case there is a shortage, etc. Even today, though the conditions have changed, the *mamulnama* rules are seen by the people as the points of reference against which they see what is right and what is wrong.

The rise of colonial power played a havoc with tank irrigation. Violent conflicts which preceded the British takeover resulted in the destruction of numerous tanks. The British introduced drastic changes in the land tenure system. Under the earlier system of *mirasi* or *Zamindari* tenure, land control was highly

concentrated in the hands of a few families. In *mirasi* villages, traditionally the total produce of land was shared among various groups in the community (including labourers, temple workers, fisherfolk, etc) and for various community activities. There was a congruence between the social hierarchy and the political hierarchy as the *mirasdars* always belonged to the upper castes. Thus, those who controlled the means of production were not only few in number but were also in a commanding social position. They held effective political power in the village. Under the *zamindari* system, the *zamindars* owned the tank and it was in their interest to see that the tank was maintained so that their *ryots* would be able to cultivate better and, in turn, they could get a better rent. They were even more powerful in their villages than *mirasdars* were in theirs. In other words, in the earlier times all the conditions for an effective enforcement of the commonly accepted rules for management of community facilities were met. This does not mean that the water management system was an equitable system. Rather it was a workable system because of being embedded in a social and political structure which was cohesive even as it had very distinct inegalitarian characteristics.

Another important feature of this organisation was and still is the use of lower

caste, mostly Harijans, for working the water systems. They opened and closed the sluices, disseminated the decisions regarding tank management in the community and also enforced water rationing. In normal circumstances, this would have given the functionaries an enormous amount of power. But this was neatly counteracted and emasculated by the ingenious device of using Harijans who were socially very much under the control of the village elite.

The introduction of *ryotwari* system substantially changed the structure of local authority both in *mirasi* and *zamin* villages. The diffusion of land control and the weakening of traditional elite also weakened tank management. The sociopolitical situation in the villages has further changed during the last 100 years. Land control has become more diffused and passed into the hands of the middle and lower castes. Demographic pressure has increased the number of farmers manifold. The institutions of community regulation have become more difficult to manage as the number of persons involved has increased.

Moreover, socioeconomic-political control is no longer concentrated in a few hands. There is now disjunction between the social structure, the land control structure and the political structure within the village. The local political

structure is no longer supreme. There are many points at which outside power structures intervene and intrude into the local power structures. Increase in the number of people, technological improvements and the consequent increase in the value of water has increased conflicts and added to the difficulty in ensuring proper maintenance.

The emergence of wells has changed the situation in some tanks. First, wells are normally owned by persons who would have taken the lead in enforcing collective regulations. But once they appropriate the water they need by pumping groundwater through tubewells or borewells, their interest in involving themselves in the communal maintenance of tanks and the enforcement of regulation for water usage weakens. Second, where wells have become so widespread that tank water is not important, the *ayacutdars* do not bother about the continued tank maintenance.

All this does not mean, however, that the local institutions for tank management have become defunct. Even today, in places where the tanks are the main source of irrigation and there are no significant wells in the *ayacut*, we have documented cases of regular labour contribution for cleaning the inlet channels and the distribution

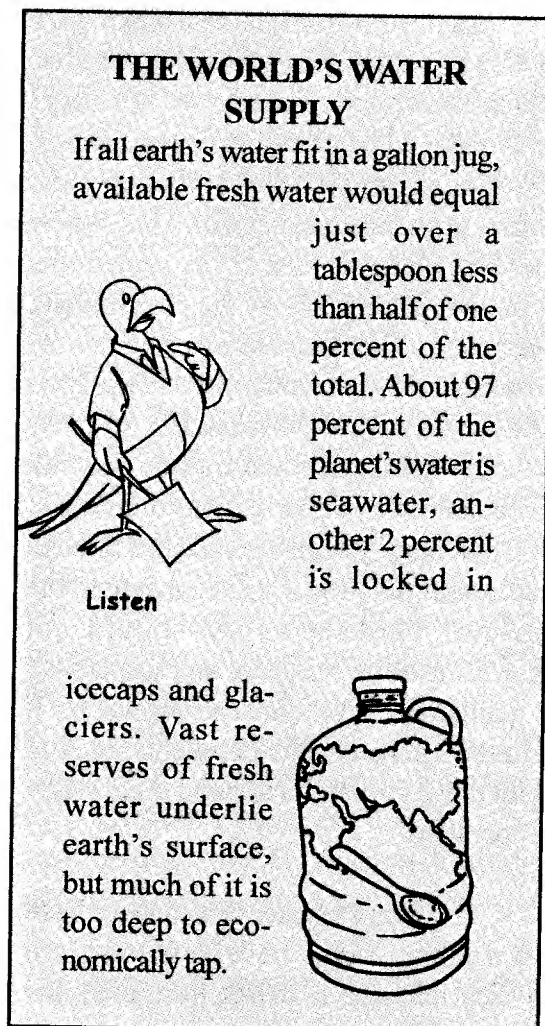
channels in the *ayacut*. Maintenance does get accomplished because that is the only way farmers get water without which they are unable to grow paddy.

Significantly, even large tanks (such as Kaveripakkam and Dusi Mamandur) which have *ayacuts* spread over 15 villages and managed by complex organisations, continue to function smoothly today and largely in an informal manner. This despite the fact that the formal organisational structure, put in place by the government, has become defunct. No elections to the board for tank-level management has been held for the past 20-30 years. But the tanks are still working; the distribution network is maintained by the irrigation community; and, rationing systems are enforced through traditional functionaries according to the custom. This shows we should not underestimate the resilience and adaptability of traditional conventional arrangements. It is in the interest of the people dependent upon these structures to have them ready in operation.

This is not to deny that changes have taken place. Tanks have suffered from physical damages or dereliction partly due to neglect (in the sense that when the bunds were breached, nobody bothered about their repair which led to the tank going out of use). The other reason is that as urban settlements expand, they take over tank



beds and either fill them up to construct houses or destroy the tank drainage channels, the inlet channels then get blocked and the tanks do not get filled up. Unfortunately, we do not have a clear



picture of the number of tanks that have fallen into disuse. The number of tanks reported by the minor irrigation census is lower than that reported by PWD,

sometimes by a large margin. The reason for this discrepancy has not been investigated. It is important to find out how many tanks have gone out of use, for what reason and what is the nature and extent of their dereliction. And, if this is done as a participatory exercise involving user communities, the users will be made aware of the problems and will be better placed to deliberate on suitable remedies.

Interrupted drainage due to construction of roads, railway tracks, etc. impedes flow; and, denudation increases the intensity of discharge, shortens its duration and reduces the amount of water which can be impounded and stored. Treatment of upper catchments to reduce surface flow and even out the pattern of surface flow from the upper catchment is often necessary. The second reason for reduced inflow into tanks is the narrowing of the inlet channels. In most places, they have been encroached upon, silted and weed-infested. The government has done some amount of repair. In some places *ayacutdars* have themselves done some work to clear the channels. But not enough.

### SILTATION IS ANOTHER PROBLEM

Siltation affects tanks by reducing effective storage capacity. Thus, if the upstream tanks were silted more than the

downstream ones, more of the surface runoff flows to the downstream tanks. The water availability in upstream storages would be reduced while the downstream storages would get more water or more frequent water. The flow to the downstream tanks from the surpluses of the upstream tank would, however, be reduced as recycling of seepage in the upstream tanks is intensified. While recycling improves quality of irrigation in areas where pumping is done, and may even help small farms in the area through the emergence of water markets, the differences between head and tail end of the *ayacut* may well get aggravated.

The colonial government did put in considerable money, during the 19th and early 20th centuries, to renovate the tank irrigation systems, particularly in Tamil Nadu where a substantial part of the irrigated area was dependent upon tanks for irrigation. The colonial administration was clearly motivated by revenue considerations. It would allow irrigation investment only if it yielded a minimum financial return.

During the later half of the 19th century, for instance, the government constructed a permanent *anicut* across the Palar and improved the distribution network, thereby augmenting the quantum and assurance of water supply to the tanks

fed by it. A similar programme was initiated in case of the Tambraparani *anicut* in the early 20th century. Moreover, in many cases the beneficiaries were willing to contribute money and material towards this end. The Tambraparani modernisation was done in this fashion. There was a substantial contribution of cash and material from the beneficiaries. But the situation has changed drastically especially since Independence.

Traditional tank irrigation has been grossly neglected under the post-Independent plans. There have been attempts at constructing new tanks, and to improve existing tanks but their scale has been very limited and their effectiveness in doubt. The results are poorly documented - we do not know how many new tanks have been constructed and at what cost. Tank construction comes under five different programmes including minor irrigation and no one has kept track of what is happening, what is spent, etc. The reported achievements are of dubious value. Thus, while the Planning Commission claims that a large number of new tanks have been constructed and their irrigation potential has increased, the land-use statistics relating to the net area irrigated by the tanks, point to a decline. This discrepancy needs to be systematically investigated.

Apart from construction of new tanks, the states have taken up programmes

for tank modernisation. Tamil Nadu has perhaps done the most in this respect. But the programmes are markedly top-down in nature and excessively preoccupied with realignment and modernisation of distribution networks and other physical improvements. The knowledge and perceptions, acquired from long and first hand experience, of the affected communities are almost totally ignored. The fact that there are functioning, even if informal, local institutions for managing tanks is more or less ignored; and, efforts are being made to set up new, formal arrangements. These programmes are also costly (as much as Rs 1,00,000 per ha) which would be neither necessary nor economically viable. We need a fundamentally different approach to modernise local knowledge and participation. We need to make adjustments and improvements which will solve the specific local problems and which work through pre-existing community institutions and which seek to strengthen rather than supplant them.

Finally, there is the question whether tanks are superior alternatives to large storages. It is important to note here that tanks are not land saving structures, in the sense of having a low incidence of land submergence relative to the *ayacut*. In fact, as tanks are shallow storages, they submerge much larger areas relative to the *ayacut* than to large reservoirs.

Moreover, tanks need a particular kind of topography and a particular kind of rainfall pattern. It is not an accident that tanks are largely concentrated in the south especially in the 2-peak rainfall regions. This allows farmers to tap some of the rainfall of the first monsoon - the southwest monsoon - and use it for raising the nursery and then go in for the second crop by the time the main rains come, which are again impounded for irrigation.

In any case large storages are essential. In our kind of rainfall and climatic regime, where conditions for groundwater storage is unfavourable over vast areas, there is no escape from such storages. This is the only way in which excess rainfall in the high rainfall areas within short periods can be harnessed and used in order to get an assured crop in the main crop season, and to increase the cropping intensity, in the extensive, relatively dry and water-scarce downstream areas. It also needs to be recalled that a sizeable and growing part of groundwater recharge depends upon surface irrigation.

While tanks are not a substitute for large storages, they could be important when used in conjunction with large storages. One of the possibilities that can be tried out is the integration of small storages with large ones. We also need to look into the prospect of increasing the

number of fillings so that the effective quantum of water available through tanks is increased. If this is done, the pressure for storing water in large storages is reduced. This is important in the light of the fact that it may be difficult to locate a sufficiently large number of sites which can be used to store the water needed.

Large canal systems are extremely difficult to manage, lacking the flexibility in local management. In contrast, wherever system tanks and other tanks are found, there are strong local institutions to manage the stored water and the distribution system that comes along with these structures. Moreover, tanks offer greater flexibility in deciding when to use the stored water. And as there is a strong community interest involved around these facilities, the decision making process becomes much stronger. In other words, the existence of tank systems improves the flexibility in the use of canal system, and improves the degree of local involvement. Tanks, therefore, reduce the need for increasing the number of large storages as well as improve the efficiency and flexibility of water management.

Thus, with regard to tanks, we need to do the following:

1. The first priority should be to see how many of them still continue to exist and what their present state is.
2. We should also try and explore the possibilities of integrated watershed management of tank command systems. This might include the clearing up of inlet channels, improving tree cover in the upstream catchment, so that the effective utilization of local rainfall can be augmented for impounding in the tank.
3. There is an urgent need to develop integrated watershed development programmes which do not just stop at afforestation and building new percolation ponds which integrate the existing facilities and make them more productive. There is no reason why these different activities should be planned and implemented separately. There should be only one integrated watershed centered programme in the local areas which would go a long way in cutting down fragmentation, waste and duplication which presently goes on. But this involves the complex and difficult problem of community management of watersheds. These problems need to be addressed explicitly and much more seriously than at present. It is essential that communities cooperate.
4. It is also important to see how many of the existing rainfed tanks can be converted to system tanks by being

linked up with reservoir systems or river diversion systems. This would lead to an improvement in the availability of water, to greater assurance of water in the existing tanks.

5. Whenever construction of new projects is resorted to, care should be taken to use the existing local storages to improve the flexibility, efficiency and management of the large surface storages.
6. With regard to improvements and modernisation, the present official policy needs to change completely and should start with the village community. It is only the local people who know the changes which have taken place and are familiar with the constraints under which these structures operate. Local know-how needs to be tapped

also with the intention of starting a process of user education. The local community can learn and evolve different ways of managing the available water, which, in turn, would lead to much higher returns per unit of water stored. Concepts of water balance, relationship between water-use and productivity, scheduling of water, moisture trends, etc are best worked out by the local community. No outside engineer can duplicate this knowledge.

If these procedures are implemented, isolated success stories like that of the Pani Panchayats in Maharashtra could be duplicated all over the country.

***Source : The Challenge of the Balance, Edited by Anil Agarwal, Centre For Science and Environment, New Delhi, 1997.***



## THE WORLD BANK AND THE WATER CRISIS

VANDANA SHIVA

**T**he deepening water crisis has sounded an alert on the most serious ecological crisis of our times. The causes for the crisis are ecological and political. The ecological roots are linked to abuse of water resources and disruption of the hydrological cycle. Ecological destabilisation of the water cycle is in turn linked to issues of political power and control. Four aspects of these ecological processes are:-

1. Deforestation of vulnerable catchments;
2. Expansion of water intensive industrial agriculture;
3. Diversion of water to water intensive industry and urban areas;
4. Climate change and the aggravation of drought.

### THE GREEN REVOLUTION AND THE WATER CRISIS

Deforestation of vulnerable catchments due to logging and mining is an

important factor in the creation of droughts and floods. When catchment forests are gone, or replaced by industrial monocultures, the ecosystems lose their capacity for infiltration and percolation, streams and groundwater sources are not recharged, the rain runs off immediately to cause floods in the monsoons and leave dry streams and rivers in the summer. It is not an accident that the first water conservation movement in India was a forest conservation movement.

The Green Revolution has also contributed to drought vulnerability by displacing drought resistant local varieties,



The green revolution displaced drought-resistant local varieties, replacing them with thirty seeds responsive to chemicals but need three to four times more water than indigenous seeds.

replacing them with thirty seeds which have a high response to chemicals but need three to four times more water than indigenous seeds. Native wheat requires 12 inches of water while Green Revolution varieties need 36 inches. Jowar and bajra, the traditional crops of Rajasthan and Gujarat need only 500 mm but rice requires 100 mm. In terms of water use efficiency, millets which have been referred as “inferior grains” have two to three times higher efficiency than rice.

Bajra has two times more protein and iron, three times more minerals, four times more calcium, than rice. Both in terms of food security and water security, millets are more productive than rice.

Yet rice acreages have spread, while millet cultivation has dramatically declined, increasing water demand and water withdrawal. Non-sustainable agricultural technologies have an important role to play in the creation of drought and water scarcity.

The shift from organic manure to chemical fertilizers has also made our soils vulnerable to drought and desertification. Organic manuring reduces run off by 50%. Soil loss can be reduced by 6 tonnes per ha with 6 tonnes per ha of organic matter. Organic residues are also food for earthworms and micro-organisms which increase the water-holding capacity of soils.

Monocultures typical of Green Revolution practices also increase risks of crop failure. Sole cropped sorghum has been found to fail once in eight years, pigeon pea once in five years, but a sorghum-pigeon pea intercrop fails only once in 36 years in experiments carried out by the Project on Dryland Farming.

The long-term solution to drought therefore lies in water conservation both through water harvesting as well as promotion of sustainable ecological agriculture based on biodiversity which prevents runoff, increased moisture holding capacity of soils, reduces risks of crop failure and reverses the life threatening processes of drought and desertification which have already engulfed large areas of our country.

The water demands of the Green Revolution have been met by large dams and groundwater mining.

### **THE WORLD BANK’S ROLE IN CREATING WATER MINE**

In the state of Gujarat, a state with severe water crisis, groundwater is mined from 1,500-1,800 ft. deep, leaving shallower aquifers and surface storage systems like tanks, dams and rivers empty.

Gujarat used to be the land of tanks and wells. In the 1930s, 78 per cent of the

irrigation was well irrigation. Water was lifted from a well by 'kos' and the energy was provided by animals.

Intensive irrigation shifted the water use technology from open wells to tube wells, financed by aid agencies. India now has more than 17 million energised wells. The World Bank has played a major role in promoting non-sustainable groundwater exploitation which is the most significant aspect of the water crisis in India.

For example, the present water crisis in Gujarat is a product of the World Bank recipes for dealing with the 1985-86 water crisis. In 1985-86, potable water was being supplied to Gujarat by special trains, tankers, camels and bullock carts. The government's crash programme in 1985-86 to provide drinking water, estimated to have cost nearly Rs. 86 crores, has left the problem as acute as ever. New sources have dried up, and the 4,000 tube wells dug have run dry. The government is now ready to spend another Rs. 93 crores on long distance transfer and on more tube wells. Gujarat also has a World Bank aided water supply project of Rs. 136 crores, but both technology inputs and financial inputs are failing in providing water in the face of the depletion of water sources themselves.

The water famine in the 1980s in Maharashtra was also a creation of the

World Bank.

Traditionally, groundwater extraction in Maharashtra has come mainly from open dugwells. Fifty-nine per cent of the state has also been irrigated by groundwater through 9.39 lakhs of open dugwells. Ninety-three per cent of Maharashtra is made up of hard rocks consisting of the Deccan Trap. In it recharge is slow because the storage space for groundwater is developed through secondary features like joints, weathering, fissuring, and so on. All these features do not occur in uniform fashion, in depth or lateral extent. In the Deccan Trap, therefore, there is nothing like a subsoil water table. Water is stored in joints and bedding planes and is recharged locally. This seriously limits the availability and recharge of groundwater, a limit which new technologies of water exploitation have tried to overcome by digging deeper and using more power for the withdrawal of water.

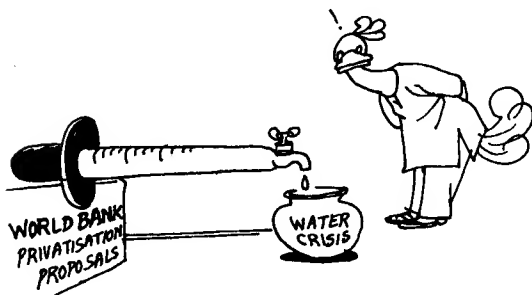
Energisation of pumps has mushroomed after the 1972 drought when financial assistance from the World Bank created heavy subsidies for mechanised withdrawal of water. The Bank gave credit for a rapid expansion of tubewells to feed commercial irrigation as well as tide over the water scarcity. As a result, sugarcane cultivation expanded rapidly. In less than a decade, sugarcane fields have converted groundwater into cash, leaving people and staple food crops thirsting for water.



The depletion of groundwater is directly linked to the expansion of energised tubewells to irrigate sugarcane. While sugarcane is cultivated on only two-three per cent of Maharashtra's irrigated land, it consumes eighty per cent of all the irrigation water and eight times more than other irrigated crops. This has necessitated the intensive use of groundwater, leading to a drying up of wells, shallow as well as deep.

### **WORLD BANK PRIVATISATION PROPOSALS WILL WORSEN THE WATER CRISIS**

The World Bank has recently initiated water sector reforms, aimed primarily at privatisation of water resources and commercialisation of water management.



The privatisation policy recommends:

- \* Commercialising operations at all levels;
- \* Private investment;
- \* Substantial increase in water prices;
- \* Increase in agricultural power tariffs;
- \* Creation of water markets.

*The report states:*

Lack of mechanisms for leasing or selling water in critically water scarce areas may represent a significant opportunity foregone....

In particular, the absence of formal rights to surface water and of formal rights to sell groundwater have hundred water transactions from low value uses to uses with higher productivity... Water resource transactions would enable water to be sold or leased from one willing user to another, making possible a reallocation of water to higher productivity uses.

In the World Bank logic of market efficiency, water wasted on flowers or shrimps is a "higher productivity use" than "low value" use for growing millets for food security and quenching the thirst of the poor who have no purchasing power. Or the poor will create purchasing power by bartering their very lives as in the case of kidney sales by poor farmers in Andhra Pradesh to finance deep tubewells.

These are recipes for conversion of water into a tradeable commodity rather than a life support base. Privatisation will aggravate the water crisis, because given the inequalities between rich and poor, industry and agriculture, urban and rural, water markets will take the water from the poor to the rich,

from impoverished rural areas to affluent urban enclaves. It will also lead to overexploitation of water, because when access to water is determined by the market and purchasing power and long distance trade and transport not by limits of renewability, the water cycle will be systematically violated and the water crisis will deepen. Local community management is a precondition for both conservation and equitable use.

The World Bank privatisation proposals do pay lip service to local level institutions, but convert the local community from common property owners to “water users”, and equate local people’s institutions with the private sector. The World Bank also refers to NGOs and private sector in the same category, indicating that the role of NGOs viewed in the context of privatisation.

Ignoring limits of water availability and the conservation imperative, the bank recommends a shift from “supply-oriented” to “demand-oriented” approach. Demands of the economically powerful will therefore override the needs of the poor and the limits of nature. Partial application of this logic through World Bank lending is not the root of the present crisis. Full implementation of the logic of privatisation will not reverse the crisis, it will aggravate it.

To prevent the waste of scarce water resources through unjust and ecologically

destructive practices, the Pani Panchayat movement was launched in 1972 by the Gram Gourav Pratisthan in Pune in Maharashtra. The central idea underlying the formation of the Pani Panchayats is that in a drought prone area, no individual should be deprived of a rightful share of the limited water resources on which life and livelihood depend. To ensure justice, the Pani Panchayats manage as a community resource, not as private property. Sugarcane cultivation was completely banned as being inconsistent with the principles of responsible and sustainable resource use in drought prone regions.

Anna Sahib’s work in Ralegaon Shindi and the Tarun Bharat Sangh’s work in Alwar are also lighthouses in the search for solutions to the crises of drought and water scarcity.

# THE GLOBAL SCENE OF WATER RESOURCES

**K.M. NAMBOODIRI**

## MAN'S INFLUENCE ON GLOBAL WATER RESOURCES

**E**veryday decisions by politicians and economists affect water resources more than we realize. For example, if a new plastics



If a new plastic industry is to be created, it may require 1000 to 2000 tons of water for each ton of product, most of which will be returned to a river as polluted effluent.

industry is to be created it may require 1,000 to 2,000 tons of water for each ton of product, most of which will be returned to a river as polluted effluent. Or, if the decision is made to boost agriculture in a dry zone by constructing an irrigation scheme, can we afford the loss of 1,500 to 3,000 tons of water for each ton of wheat? Or, again, if forests

are to be cleared to provide land for farming, will the springs dry up, the floods increase and the river become unnavigable?

The situation in which water resources are affected by man's actions is further complicated by the wide range of needs for water. Primarily water is an essential requirement of life, but it is also an indispensable dynamic agent. In nature, it transports the eroded material from mountains and forests to the plains and the sea; man uses it to carry away his wastes and to produce electric power. It is also used for navigation, it produces food, and is a source of recreation. In many cultures water has a religious significance. This key element of the environment has so many uses for man that it is not surprising that these uses sometimes conflict. In the past, when the growth of demand for water was small in relation to untapped resources, the conflicts between different requirements were generally of only local concern. The situation has now changed.

So long as man was a relatively insignificant element in the whole balance of nature his power to disturb this balance was

small. Now, however, his technology is becoming so powerful that he can bring great changes on continental and even global scales and the need to foresee the consequences of his actions has become a condition for survival.

## WATERS OF THE EARTH

The total amount of water in the hydrosphere has been estimated at about 1,500 million km<sup>3</sup>. One way of envisaging this quantity is as a uniform depth of about 3000 metres over the entire surface of the earth.

Practically all this water (estimates vary between 93 percent and 97 percent) is contained in the oceans and salt seas. Of the fresh water resources of the earth (i.e. about five percent of the total water), the proportion stored in the form of snow and ice or permafrost - and thus not readily available for use - has been estimated at about three quarters of the total fresh water. About half of this frozen fresh water is contained in the polar ice caps.

Consequently, only about one percent of the total water in the hydrosphere is in a form that can be readily and economically exploited by present-day technology. Of this available water, 99 percent is in the form of groundwater (about half of which may be more than 1000 metres below the surface) and only about one percent is in the form of surface water stored in lakes. The amount of



water held in the soil above the groundwater has been estimated at about one fifth of the amount stored in lakes and the amount of rivers at about half again.

The total amount of water vapour stored in the atmosphere has been estimated at about equal to that stored in the rivers; about one-fiftieth of one percent of all fresh water. The final element of the water resources of the earth is the water contained in the biomass or biosphere, which can be guessed as being of the order of one thousandth part of one percent of the total fresh water resources. More than 99 percent of this biological water is represented by the vegetation cover.

Though the estimated amounts of water in the atmosphere and in the biosphere are relatively insignificant, they play a key role in the movement of water through the hydrological cycle.

***From : Integrated Approach Towards a Sustainable Future.***

## THE POLLUTION OF OUR RIVERS AND SEAS

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SARALA DEVI

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**95%** of the world's water is contained in the saline oceans. Of the remaining 5%, 75% is enclosed in polar ice and glaciers. Less than 0.5% of the world's water is in a form which is readily available for use by man.

Mechanisation and 'scientific' agriculture have called for continually escalating inputs of water. Including the production of chicken feed, it takes 10,000 liters of water to produce ten large eggs, 1500 to produce a kilo of wheat, 4,500 litres to produce a kilo of rice and 30,000 litres to produce a kilo of beef.

Plants not only use these huge quantities of water at a minimal cost, but as a result of 'scientific' farming, it is returned to the water systems of the world in a polluted condition.

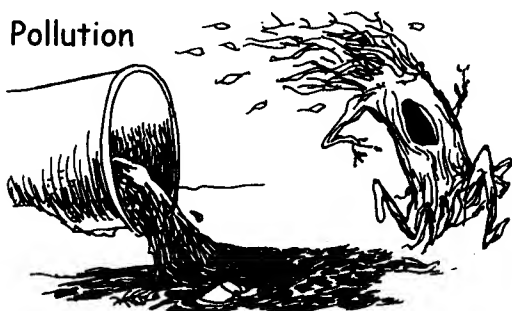
In the factory, for cleaning and cooling, there is an exponentially increasing colossal demand for water. In America 150,000 litres of water are required in the production of one ton of steel, 300,000 in the production of one ton of paper,



In America, 150,000 litres of water are required to produce 1 ton of steel;  
300,000 litres for 1 ton of paper;  
800,000 litres for 1 ton of viscous rayon;  
2000,000 litres for 1 ton of synthetic rubber; and  
1000,000 litres for 1 ton of streptomycine.

8,00,000 in the production of one ton of viscous rayon, 20,00,000 litres in the production of one ton of synthetic rubber, and one million tons in the production of one ton of streptomycine.

Yet in industrial costing the expenditure on water amounts only to between 0.01% and 2.5% of factory cost, averaging 0.4%. This water is also returned to the world's waterways in a seriously polluted condition. The expense of its consumption and pollution is borne by the public. If charges on this head fell on the industries concerned manufacturing costs



would increase exponentially and this in itself might be sufficient to disrupt the present social economic and political organisation of society.

This usable water can be obtained from two sources, 20,000 kms (one km of water is equal to 265 billion gallons) of surface water and eight million km of groundwater, which could appear to be more than sufficient, but we suffer in place from floods and in places from droughts. Desertification increases. In Africa in many parts drinking water is carried daily from a distance of four miles and in other parts people relax in aromatic swimming pools. However, the underground water is mostly at a depth of over 750 metres, and is therefore mostly not available for man's exploitation. 200,000 kms may be readily available.

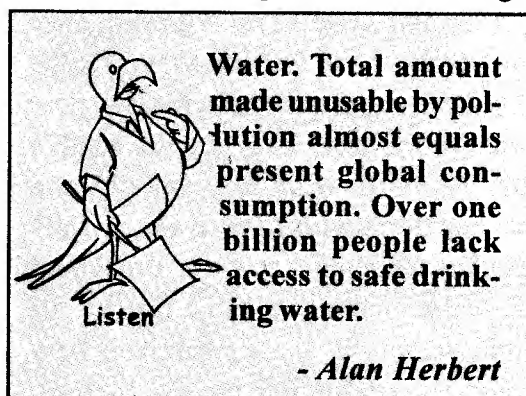
The daily hydraulic cycle is 1100 kms of which 260 kms reaches the earth is mostly absorbed by plants and trees. (Which ultimately return water in excess of their needs to the atmosphere.) About 70

kms is available for direct use by man. Even for our present population this would average 17,000 litres per day per person. However, in addition to the inequality in demand and supply caused by agriculture and industry, the distribution is uneven on the regional, seasonal and annual levels.

## POLLUTION

*The main polluting sources of water are:*

1. Organic sewage and industrial wastes.
2. Organic chemicals detergents, herbicides, pesticides.
3. Manufacture of chemicals, metals, metal compounds, salts and acids.
4. Infectious agents from hospitals, slaughter houses, tanneries and large cities.
5. Radio-active substances, heat, soil and mineral particles.
6. Nitrates and phosphates, which cause undue proliferation of algae



and water weeds, leading to eutrophication. The future economic policy for the management of water should be:

1. Re-cycling and re-using and reducing waster.
2. Purification of serage. Polluted waste water should be kept separate from supplies of pure water.
3. Modification of the weather pattern by re-afforestation, the construction of small-scale reservoirs, the prevention of soil erosion and the conservation of our water sheds.

## THE FUNCTION OF RIVERS

The distribution of liquid in organisms follows three different plans. 1. Distribution outward through arteries and inward through veins. 2. Local distribution through the capillaries. 3. Storage in tissues, cells and larger organs.

Rivers follow the same pattern. They flow overland and underland, and to be utilised, they must maintain a tranquil flow while on dry land. They are the eaeth's water veins, flowing horizontally and renewing the surplus of used water. They are fed by the smaller streams. Branching out at the mouth is a basic law for all healthy organisms, si our great rivers flow through their deltas into the sea. In trees,

the trunk, branvches and twigs follow the same pattenm.

*From: Revive Our Dying Planet.*

### RECYCLING WASTE WATER

*Raw sewage contains complex organic and inorganic materials. Through research it was*



*discovered that some aquatic weeds can scavenge inorganic, and some organic, compounds from water. The weeds absorb and incorporate the dissolved materials into their own structure. Effluent renovated by the plants is stripped of its pollutants and, when released into waterways, causes less environmental damage. The aquatic plants clean water so rapidly and effectively that they are now considered worldwide for sewage treatment. The clean water produced is in most situations suitable for re-use in irrigation and industry. Furthermore, the plants themselves can be harvested and used, thus providing additional benefits. The technique can also be used for treating animal manure and other farm wastes.*

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## THE ECONOMICS OF WATER

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MARYADHA RAMA

was a Judge famous in Tamil folklore for his wit and wisdom

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One day two women litigants came to him. The first mother complained the other woman Patlu had borrowed 10 kilograms of buffalo ghee from her and is not returning it in time.

Intervened Patlu, "No Sir, it is Mothu who has taken 10 kg of buffalo ghee from me, please make her return the ghee or pay up".

The judge was perplexed. "How many buffaloes has each of you?" he asked.

"I have ten animals" replied Mothu, "I have one dear animal" said Patlu.

Ok. Now you go away! But be sure, you are present at 10 o' clock in the morning at the court tomorrow. I shall settle your case".

Both the women departed in different directions calling each other names.

In the evening Rama had the courtyard dug up with a spade, and poured

bucketfuls of water on the clayey soil. The whole courtyard was a single pool of slimy muddy mire.

At the appointed hour the next day, both women reached the court, walking through mire. There was mud stuck to them up to their knees.

Maryadha Rama gave each woman a small mugful of water to wash off the mud. Mothu poured in one throw the mugful of water on her feet



and asked for more water. Patlu, took her share of water poured the water ounce by ounce on her feet removed the mud with



her fingers, cleaned her limbs and saved a small portion of the water in the mug.

Maryadha Rama was watching the women closely. He knew a person's attitude towards her life will be reflected in her attitude towards water.

He thundered at Mothu "you wretched spendthrift! confess your crime! or I shall have you whipped".

Mothu was crestfallen. She confessed "Sir I thought the world will be taken in by my ten buffaloes, and will believe that it is I who lent Patlu ten kg of ghee. True I have been careless with spending, and I had to borrow ghee from my neighbour Patlu".

Rama levied a small fine on Mothu apart from Patlu's dues and gave it to the village fund.

### COST OF WATER

- \* Less than 1 per cent of the total water available on the earth can be used for human consumption.
- \* 99.5 per cent of all fresh water is contained in the polar ice-caps.
- \* 50 litres of water are needed to grow a kilo of spinach.
- \* 50 litres of water are required to produce a kilo of whisky.
- \* 250 litres of water are needed to produce a kilo of wheat.
- \* 250 litres of water are required to produce a kilo of steel.
- \* 18,000 litres of water are required to refine a tonne of petroleum.
- \* 25,000 litres of water are needed to produce a kilo of meat.
- \* 200,000 litres of water are required to smelt a tonne of pig iron, 500,000 litres for a tonne of copper.



- \* 3,000,000 litres of water are needed to grow a hectare of corn.
- \* More than 3,000,000 litres of water are required every minute in a 1 million KW capacity atomic power station.
- \* 4,000,000 litres of water are required so that a tonne of synthetic fibre can be obtained.
- \* 8,000,000 litres of water are needed to grow a hectare of cabbage.
- \* 12,000,000, 20,000,000 litres of water are needed to grow a hectare of rice.

- R.K. Sinha

*Indira Gandhi Centre for Human Ecology,  
Environmental and Population Studies,  
Jaipur, Rajasthan.*

## A DELUGE OF PROBLEMS

**ANIL AGARWAL, SUNITA NARAIN, ET AL.**

**I**ndia is the most flood affected country in the world after Bangladesh.

- ❖ India accounted for one-fifth of the global death count due to floods from the 1960s to the 1980s. Over 30 million people were displaced annually.
- ❖ Annual flood damages increased nearly 40 times from an average of Rs 60 crore a year during the 1950s to an incredible Rs 2,307 crore a year during the 1980s. The flood affected area shot up from an average of 6.4 million hectares a year in the 1950s to nine million hectares a year in the 1980s.
- ❖ Flood relief expenditure more than doubled from Rs. 230 crore in 1980-81 to Rs. 567 crore in 1985-86 with Uttar Pradesh, Bihar and Orissa figuring regularly in the list as major beneficiaries.



A deluge of problems

But of late floods have also begun

❖ The five most flood prone states are Uttar Pradesh, Bihar, West Bengal, Assam and

to be serious in Andhra Pradesh, Rajasthan, Haryana and Gujarat.

- ❖ Official data on floods is hard to get and it is full of discrepancies - almost as if there is a deliberate exercise in disinformation.
- ❖ Floods are social disasters which affect the poor more than the rich. One disaster makes the poor more vulnerable to the next and converts a disaster into a disaster process.
- ❖ Government flood control measures mainly consist of dams and embankments. Over 400 km of embankments have been built annually since 1954.
- ❖ In all 256 large dams, with an average height of 15 metres and above, had been constructed by 1986 and 154 more were under construction.
- ❖ All these efforts have failed to control floods. Dams have become an important cause of floods. Embankments have disrupted the natural drainage system in the flood plains.

*From : Floods, Flood Plains and Environmental Myths, Centre for Science and Environment, New Delhi, 1991.*

## **EMBANKMENT ILLS**

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**ANIL AGARWAL, SUNITA NARAIN**

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**C**onstruction of embankments worsens the problem of floods overtime, the common negative effects being:

### **REDUCED PASSAGE**

By confining the flood waters to the river channel and a small part of the flood plains, embankments, in case of a river whose bed is rising, force the sediment load, which would earlier have been deposited over a much wider area of the flood plains, to be deposited within the embanked area. This results in higher flood levels, and may also lead to a breach in the embankment. Thus to give the level of protection initially envisaged, progressive raising of the embankment becomes inevitable. A vicious race then commences between the rise of the river bed and the raising of the embankment.

### **REDUCED NATURAL FERTILITY**

This process further deprives the wider flood plains of the rich silt deposits left behind by receding flood waters traditionally an important source of fertility enrichment in the flood plains.

### **BUILD UP OF FLOOD WATERS**

By constricting the river's natural flood plains, embankments lead to a dangerous build up of high flood levels within the embanked area. At the same time they tend to engender a false sense of security in the people inhabiting the surrounding flood plains. Thus, in case of a breach, the flood waters literally cascade upon the surrounding countryside adding considerably to the magnitude and reach of their devastating potential.

### **DRAINAGE CONGESTION**

The construction of embankments cuts off the natural drainage from the flood protected areas into the river except through predetermined drainage sluices provided in the embankment. The capacity of the artificial drainage sluices is never equal to the previous waterways available for natural drainage into the river. The problem of drainage congestion, therefore, gets aggravated in the flood protected area. The Rashtriya Barh Ayog (RBA) report states, "Embankments are not a feasible

measure of flood protection in cases where the country runoff draining into the river is so large as to inundate appreciatively the area protected by the embankments from river spills, during periods when the river is running at high flood stages”.

Drainage congestion becomes still more acute in cases where tributaries join the main river along which embankments have been provided. Tributaries with large catchment areas may carry considerable discharges, which are difficult to

accommodate in sluices. In such conditions, engineers usually respond with sympathetic or back embankments along the tributary so that the flood water of the main river cannot inundate the countryside by flowing up the tributary and spilling along its bank. But at the junction of the back embankment and the main embankment - particularly the upstream junction - drainage congestion becomes an acute problem. Huge quantities of water can collect at such junctions.

## WATERLOGGING

In the case of a river, whose bed is rising rapidly after embanking, the water level can reach a point that it remains higher than the surrounding countryside throughout the year. In such conditions, the flood protected area along the embankment will get waterlogged.

## RIVER ATTACKS DUE TO SHIFTING COURSES

A shifting river can make unexpected erosion attacks on embankments and necessitate expensive responses.

*From : Floods, Flood Plains and Environmental Myths.*

### Ecological effects of embankments

Unembanked river

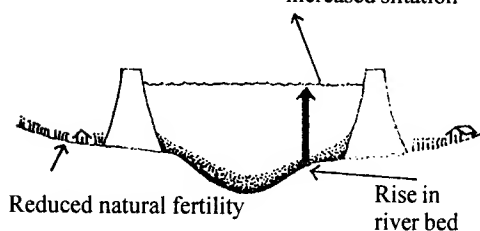


Unembanked river in flood



Embanked river in flood

Higher flood levels due to reduced flood plain and increased siltation



## DAMS

**T**he dams in India have created a furore because they destroy the environments, centralise water management, do not succeed in solving the problems. They are supposed to solve and displace people. Generally irrigated land goes out of the hands of the poor and the poor are not able to switch over from unirrigated agriculture to irrigated farming. Promises of rehabilitations are invariably not kept.

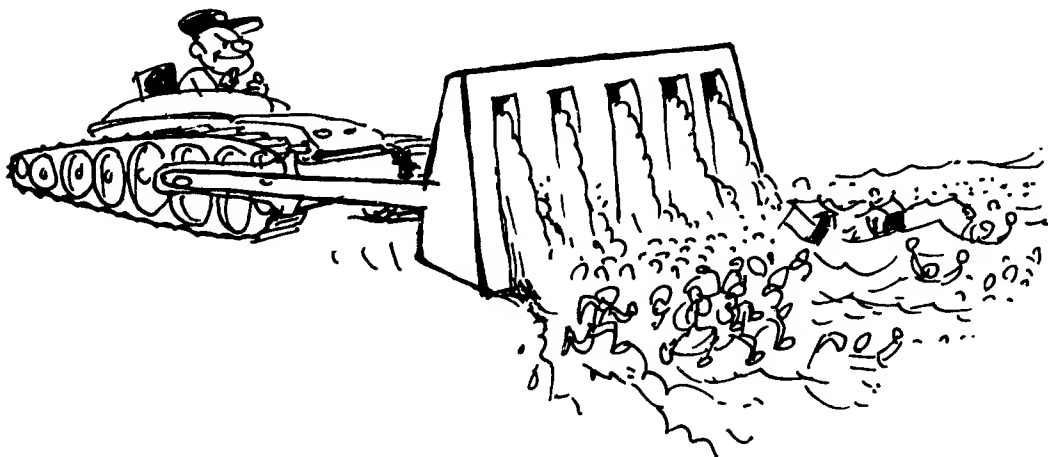
Great controversies rage between (1) energy and water planners stressing hydropower and canal irrigation on the one hand and (2) ecologists, tribals, mourning

loss of human and floral, faunal habitats on the other.

Mostly the poor, the tribals and the powerless people suffer, when we argue, "some one has to suffer for progress."

Narmada Dams actually the "Narmada Basin Development plans" will displace a million people when completed. This programme will involve the construction of 329 large dams.

Large dams also drown forest lands half a million hectares of them against 5 million hectares of new lands irrigated.



What is needed? Small earthen dams, for water harvesting. They are eco-logically sound, economically profitable. There is no soil erosion, no deforestation, no desertification, no displacement of human beings. Yes, for water conservation. No, for very big dams is the consensus.

In places like Silent Valley, Bodhghat and Bedthu, environmentally conscious mass protests have saved special forests. Where rehabilitation has been the key issue the protests have not worked.

Today India has 14-22 million people who have been displaced by dams.

The governments, activists, funding agencies including the World Bank have started reshaping their policies on dam building.

Problems include (1) failure to take the affected people into confidence (2) no sharing of information (3) cost escalation due to delays (4) local water conservation and watershed development are neglected.



## WHAT IS WATER HARVESTING?

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DR. R.N. ATHAVALE

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**T**he term water harvesting refers to collection and storage of rain water and also other activities aimed at harvesting surface and groundwater, prevention of losses through evaporation and seepage and all other hydrological studies and engineering intervention aimed at conservation and efficient utilization of the limited water endowment of physiographic unit such as a watershed.

The various topics which can come under water harvesting and conservation are:

1. Construction of permanent/portable storage structures.
2. Farm ponds, either for supplemental irrigation or for augmentation of brown water.
3. Checkdams.
4. Percolation tanks at appropriate sites based on geological considerations, design of percolation tanks.
5. Reclamation, revitalization of traditional water arresting structures.
6. Artificial recharge through wells.
7. Control of evaporation from surface water bodies.
8. Prevention of seepage losses in appropriate situations.
9. Enhancement of run off through mechanical and chemical treatment in catchment area.
10. Subsurface dams to arrest baseflow of groundwater.
11. Soil and water conservation practices comprising contour and terrace building.
12. Control of sea-water incursion in coastal aquifers.
13. Control of transpiration without affecting normal plant growth.



## DYING WISDOM : TRADITIONAL WATER HARVESTING SYSTEMS, WATER RIGHTS AND THE ROLE OF COMMUNITIES

Traditional water harvesting techniques have been severely eroded. Modern attempts to restore them must reckon with the causes of their decline. Modern water technologies have often been imported from the West without due regard to local specificities. Some conclusions and recommendations:

- \* There is nothing backward about the technology of traditional water harvesting systems. They are not merely relevant; they are necessary and, in some cases, even vital.
- \* Modern water management systems have failed to integrate water management with care for the catchment areas.
- \* Choice between traditional and modern water systems should take account of intangible benefits such as soil and water conservation.

- \* A scheme of water rights should be incorporated into the Constitution after extensive debate and discussion. Individuals and households ought to have the right to harvest all the precipitation that falls over their property. But they should not have the right to take any water from underground aquifers without permission of the community, or from a stream or any body of surface water that depends on inflows from catchments beyond the limits of privately owned property.
- \* The local community, represented by an appropriate institution, should have absolute right on all rainwater that falls over common land, local aquifers and other public properties.



Old lamps  
for new

- Source : Agarwal and Narain (1997)

## PLANNING FOR WATER

A fascinating piece about culture and water was published recently in a Japanese magazine. It compared Roma (Rome) with Edo (the city out of which grew Tokyo). Very unlike the highly courteous Japanese, the article mocked ancient Rome's water supply system. Romans used to build huge aquaducts that ran for tens of miles to bring water to their settlements.

These aquaducts represent the utter stupidity of the Romans. Rome was built on the river Tiber. The city did not need an aquaduct. But the Romans polluted the river and then had to bring water from far off

places. As a result, water outlets were few, and the elite swiped off most of it using a system of slaves.

On the contrary, traditional Japanese never threw their muck into a river. They would use a dry bin for human excreta and then use it on the fields. As a result, Edo had numerous water outlets and a much more egalitarian water supply even though the Japanese society was just as inegalitarian as Roman society.



Old lamps  
for new

- Anil Agarwal.



## **RAIN WATER HARVESTING AND GROUND WATER RECHARGE**

### **DO YOU KNOW?**

**G**round water levels in some areas are falling at the rate of one meter per year and rising in some other areas at the same rate.

You can capture and recharge 65,000 litres of rain water in Delhi from a 100 square meter size roof-top and meet drinking and domestic water requirements of a family of four for 160 days.

Central Ground Water Board implemented the first Water Harvesting and Recharge Project in 1976 in Haryana, 1980 in Gujarat and 1988 in Kerala.

❖ The number of wells and borewells for irrigation in the Country has increased five fold to 175 lakhs during past fifty years.

❖ There are 25 to 30 lakh wells and borewells for drinking, domestic and industrial uses.

❖ More than 80% of rural and 50% of urban, industrial and irrigation water

requirements in the country are met from ground water.

### **GROUND WATER RESOURCES**

*Annually replenishable resources are assessed as 432 Billion Cubic Metres (BCM).*

*By adopting water harvesting, an additional 160 BCM shall be available for use.*

### **CAUSES OF FALL IN GROUND WATER LEVELS**

Over-exploitation or excessive pumpage either locally or over large areas to meet increasing water demands,

Non-availability of other sources of water. Therefore, sole dependence is on ground water,

Unreliability of municipal water supplies both in terms of quantity and timings driving people to their own sources,

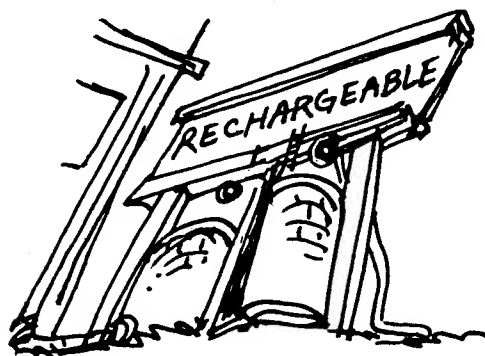
Disuse of ancient means of water conservation like village ponds, baolis, percolation tanks and therefore, higher pressure on ground water development.

### **OVER EXPLOITATION OF GROUND WATER RESOURCES EFFECTS**

- \* Drastic fall in water levels in some areas.
- \* Drying up of wells / borewells.
- \* Enhanced use of energy.
- \* Deterioration in ground water quality.
- \* Ingress of sea water in coastal areas.

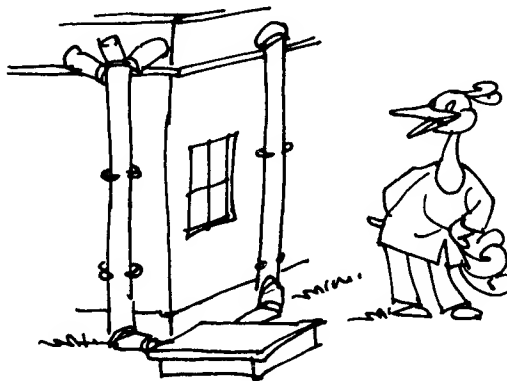
### **METHODS AND TECHNIQUES**

Roof-top rain-water harvesting and its recharge to underground through existing wells or borewells or by constructing new wells, borewells, shafts or spreading basins.



Capturing and recharging city storm water run-off through wells, shafts, spreading basins, storm water drains.

Harnessing run-off in the catchments by constructing structures such as gabions, check dams, bhandaras, percolation trenches, sub-surfaced dykes etc.



Roof-top rainwater can be harvested and recharged through existing wells or borewells.

Impounding surplus run-off in the village catchment and watersheds in village ponds and percolation tanks.

Recharging treated urban and industrial effluents underground by using it for direct irrigation or through recharge ponds, basins or wells, etc.

### **OBJECTIVES**

- \* Restore supplies from the aquifers depleted due to over-exploitation.
- \* Improve supplies from aquifers lacking adequate recharge.

- \* Store excess water for use at subsequent times.
- \* Improve physical and chemical quality of ground water.
- \* Reduce storm water run-off and soil erosion.
- \* Prevent salinity ingress in coastal areas.
- \* Increase hydrostatic pressure to prevent / stop land subsidence.
- \* Recycle urban and industrial waste waters, etc.
- \* Rehabilitate the existing traditional water harvesting structures like village ponds, percolation tanks, baolis, tankas, etc.
- \* With minor scientific modifications and redesigning, convert the traditional water harvesting structures into ground water recharge facilities.
- \* Use the existing defunct wells and bore-wells after cleaning and also the operational wells as recharge structures.

### EXPECTED BENEFITS

- \* Rise in ground water levels in wells.
- \* Increased availability of water from wells.



- \* Prevent decline in water levels.
- \* Reduction in the use of energy for pumping water and consequently the costs.
- \* Reduction in flood hazard and soil erosion.
- \* Benefiting in the water quality.
- \* Arresting sea water ingress.
- \* Assuring sustainability of the ground water abstraction sources and consequently the village and town water supply systems.
- \* Mitigating the effects of droughts and achieving drought proofing.
- \* Reviving the dying traditional water harvesting structure and their rehabilitation as recharge structures.

- \* Effective use of lakhs of defunct wells and tubewells as recharge structures.
- \* Upgradation of social and environment status, etc.

### PROPOSED POLICY MEASURES

- \* Provide at least one roof-top-rain-water harvesting structure for every 200 square meter plot in urban areas.
- \* Revive / rehabilitate all village ponds.
- \* Subject to technical feasibility, provide at least one check dam / KT weir/sub - surface dyke in each streamlet with a catchment of 1 to 3 Sq. Km.
- \* Provide all drinking water wells with a recharge structure.
- \* Ban construction of irrigation wells / tubewells within a distance of 200m or less (depending on scientific criteria) of the drinking water supply well.

### CENTRAL GROUND WATER BOARD

#### *Maharashtra*

- \* In Yaval taluka, Jalgaon District, six percolation tanks, two recharge shafts and one injection well were

*Watershed development programmes have yielded significant economic and environmental benefits. They*



*have resulted in better crop yields, improved fuel and fodder availability, regeneration of degraded lands, increase in the water-table and moisture availability, which, in turn, has helped in the better use of land based on their capabilities.*

*Watershed development programmes, thus, offer the disadvantaged dryland farmers of India a chance to benefit from improved technologies and programmes that are better suited to the economy and ecology of their regions.*

constructed - A total of about 546 ha area benefited.

- \* In Amravati district, three percolation tanks and ten cement plugs benefiting an area of 280 ha and 100 ha respectively have been constructed - Rise in water levels upto 10 meters recorded.

#### *NCT of Delhi*

- \* Artificial recharge through 4 check dams in JNU and IIT created storage

of 4,600 to 22,180 cubic metre - Water levels in the wells recorded rise of 0.8 to 9.9 m & area of 75 ha benefited.

- \* Roof top rain water harvesting and recharge through two injection wells in IIT campus - Rise of 0.51m in water levels.

### ***Chandigarh***

- \* Roof top rain water harvesting to recharge ground water through injection well in one of the CSIO buildings - Rise of 2 m in water level.

### ***Karnataka***

- \* In Mulbagal taluk of Kolar district, constructed 21 check dams, 23 boulder checks, 460 sq.m. vegetative checks, 790sq.m. gully revetment, one percolation tank, 35 rubble checks and desilted two minor irrigation tanks - Rise of 5-10 m in water levels in the area. Crop intensity increased from 150 to 200%
- \* Gravity recharge through borewells in two areas in Gauribidanur taluk led to rise in water levels.

## **SUCCESS STORIES : STATE GOVERNMENTS**

### ***Madhya Pradesh***

- \* More than 1000 check dams, 1050 tanks and 1100 community lift

irrigation schemes implemented in Jhabua district, Madhya Pradesh - Drought proofing achieved and food production increased by 38% in the past five years.

- \* Micro-watershed project with people's participation in Ghelhar Choti village, Jhabua district - Cultivable area increased and yield per ha doubled.
- \* Low cost small farm reservoirs along with improved crop and soil management systems tried in Chhattisgarh region, Madhya Pradesh - Augmented ground water storage, saved paddy from water stress during extended dry spells in 1990-91 and 1991-92.
- \* District Administration in Dewas made roof top rain water harvesting mandatory for all houses having tubewells and banned tubewell drilling - Improved soil moisture and recharged first aquifer.

### ***Gujarat***

- \* DRDA in Rajkot, Gujarat implemented 50 micro-watershed projects - Rise in ground water levels reported.

### ***Andhra Pradesh***

- \* Percolation tanks and check dams

constructed in chronically drought affected Rayalaseema region helped in drought proofing.

### ***Maharashtra***

- \* More than 7,000 percolation tanks built in Maharashtra after the severe drought of 1971-72. All areas under the influence of the percolation tanks converted into green lands.

### ***Tamil Nadu***

- \* Chennai Metro Water Board has made roof top rain water harvesting mandatory under the city's building regulations. The decision has led to a rise in ground water levels.

## **NON - GOVERNMENT ORGANIZATIONS**

### ***Gujarat***

- \* Sadguru Water & Development Foundation constructed a number of concrete check dams involving local residents and implemented watershed management in Thunthi Kankasiya village in Dahod district - Villages get water round the year and ground water levels have risen.
- \* In Dhoraji village of Rajkot district, the farmers have started recharging their wells - Crop cultivated even during drought.



### **CATCH WATER WHERE IT FALLS!**

#### ***The President sets a precedent***

Guess how much water is used by the President's Estate - 2.5 million litres every day! And yet, if you could catch all the rain that fell on it, it would help reduce the Yamuna's floods! The President of India, Shri K.R. Narayanan, has decided to set an example. Centre for Science and Environment was invited by him to make a plan for water harvesting on the President's Estate. The President seemed pleased after reading their first survey report and remarked, "It's a good beginning."

- \* Development Support Centre implemented micro-watershed projects - Drinking water problem solved to a great extent.
- \* In Raj-Samadhiyala village in Rajkot district, villagers built 12 check dams - the village once declared a desert area is no more a water scarce village.
- \* Residents of Gandhigram village in Mandvi taluka of Kutch district

constructed a dam on Khari river and undertook a micro-watershed project - Drinking water needs and irrigation of additional area of 400 hectare (ha) achieved.

- \* Roof-top rain-water harvesting and recharging of wells as a movement initiated by the Saurashtra Lok Manch Trust in Mandlikpur village of Rajkot district has prevented drying up of wells.
- \* Agakhan Rural Support Programme in Junagadh and Surendranagar districts, Saurashtra harvested rain-water by check dams and percolation ponds involving beneficiary farmers - optimum utilization of harvested rain water achieved.
- \* Vivekanand Research and Training Institute in Kutch Bhavanagar, and Amreli districts constructed rain water harvesting structures - Helped in improving ground water quality and controlling the decline in water level.

#### ***Maharashtra***

- \* Experiments of catchment treatment carried out at Adgaon and Palaswadi in Aurangabad, Ralengaon Siddhi in Ahmednagar and Naigaon in Pune by

Shri Anna Hazare - Efforts have led to revival of streamlets and enhanced availability of ground water in the water-shed.

#### ***Rajasthan***

- \* Tarun Bharat Sangh has taken up desilting and deepening of village ponds and built water harvesting structures and johads with villagers participation in more than 750 villages - The dried up streams have become perennial.
- \* In Jodhpur district, Gramin Vigyan Vikas Samiti motivated the residents of 25 villages and built 2000 storage tanks (tankas) - Each house has a tanka (a water collection structure) lined with lime and alum to keep the water fresh for four to five months.

#### **SAVING OF ENERGY PER WELL FOR LIFTING OF GROUND WATER**

- \* 1 meter of water level saves about 0.40 KWH of electricity.
- \* 1,460 KWH assuming 10 hours of pumping per day for 365 days.

***Courtesy : The Hindu, 23 May, 2000.***

## **BIODIVERSITY**

**Ostrich :** Such a wide variety of food grains, vegetables, animals, insects is a bother. The creation will be better off with fewer things to manage.

**Parrot :** We do not even know why many of these living things, both flora and fauna were created.

What use could a flea ever have?

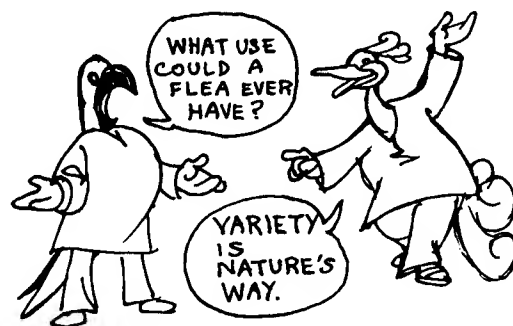
**Swan :** Variety is nature's way. Variety is nature's safety net for survival. Fewer the varieties of animals and grain species, greater the risk of pests, diseases, death, the whole species being wiped out. Variety, biodiversity is nature's store room, resource pool, from which civilisation has drawn its resources of disease resistant seeds, high yield seeds, high milk yield cows etc. And forests and natural habitats of these resources are their natural living grounds along with their relatives and friends as it were. Preserving biodiversity in natural habitats is man's greatest hope of being comfortably fed, clothed and sheltered in the future too.

There will be no sustainability without biodiversity conservation and preservation; and protection of biodiversity sanctuaries, habitats.

**Ostrich :** We can artificially create all these objects and forms. After all man has synthesised life.

**Parrot :** Not everything can be made by man. We should leave something to Nature.

**Swan :** The Mother Nature has some unique features. Man with his small fund of knowledge has not gauged the depth and variety of life forms. What man has surveyed and named is only a small percentage of the existing living forms.





**Ostrich :** But I wonder why the creator brought into existence cockroaches, flies, fleas, etc.

**Parrot :** Human beings should confine themselves to what they understand and leave the rest to itself.

**Swan :** Nothing is useless or purposeless in creation. We may understand the use of some life forms and not of others. That does not mean man should wipe out everything he does not understand or see the use of them all in his petty scheme of life. Nature has its own sense of utility irrespective of man's value system.

**Ostrich :** Man is unique. Man is witness to all creation. Man was all Nature.

**Parrot :** But man needs Nature and depends upon Nature.

**Swan :** Man is a part of nature and nature is an extension of man. The death of every animal severs man's link with nature and cuts a strand in the grand web of existence. The loss of every plant

makes man lonelier, exposed to greater and crueller risks of loneliness and death.

Every species when it dies, marks the destruction of an ecological niche. When it lives it marks a living niche. Out of this grand variety of species of plants and living beings, India's Rishis realised the great truth, "Ekam Sat Vipra Bahuda Vadanti" - "Truth is one, the wise call it by various names."

While others were looking at the external differences, non-unity and varieties, the Rishis had the vision, the *Divya Chakshu* to see the underlying unity.

This realisation prompted Sri Krishna to tell Arjuna, "The knowledge by which the one Imperishable Being is seen in all existences, undivided in the divided, know that knowledge is equilibrium (*Sattvika*).

*Sarvabhutesu yenaikam bhavam  
avyayam ikshate  
Avibhaktam vibhakteshu tad jnanam  
viddhi sattvikam*

Gita (18/20)

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## HARMONIZING BIODIVERSITY CONSERVATION AND AGRICULTURAL DEVELOPMENT

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NOEL VIETMEYER

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**F**or most of human history people have depended on hunting, fishing, and gathering for their sustenance. Finding food was fraught with danger because many of the world's 250,000 plant species are poisonous. Over tens of thousands of years of trial and error, however, our ancestors identified about 20,000 species of plants with leaves, seeds, stems, fruits, pods, shoots, flowers, stems, tubers, or other parts that were safe to eat. They also found 2,000 edible mushrooms. And they probably regularly ate most of the world's 3,500 mammals and 9,000 birds, not to mention some reptiles (such as iguanas), amphibians (especially frogs), and about 1,000 insects. In sum, prehistoric people collectively employed an enormous reservoir of food biodiversity — all of it wild.

During this trial-and-error period a few useful plants were probably protected or encouraged near campsites. Then about 10,000 years ago agriculture began in earnest as people started to cultivate some promising plants. Plant domestication began independently in Africa, China, the

Middle East, South and Central America, and Southeast Asia. But during the transition to agriculture no one understood pollination, genetics, fertilizers, microbial pest organisms, or the other knowledge that we now consider indispensable for domesticating any species.

### NARROWING USED SPECIES

With the passing millennia, farmers understandably focused on the plants most amenable to their conditions. From the 20,000 edible species about 3,000 were sampled. Eventually only a few hundred became seriously cultivated in fields and gardens. In the last fifty years or so less than 100 crops and 24 domesticated animals have been significant enough to be included in global lists of agricultural crops.

(i) Today the food base is smaller than ever: a dozen crops now feed most of humanity. These pillar crops include cereals such as barley, maize, millet, rice, sorghum, and wheat; several root crops such as cassava, potato, and sweet potato; and a handful of legumes such as beans,

peanuts, and soybean; and bananas, coconut, and sugarcane.

(ii) In the same way the number of species used in forestry has also narrowed. At least 50,000 species of trees exist, yet conifers comprise 70-80 percent of the roughly 100 million hectares of forestry plantations. Even among cultivated conifers only a small range of the available species is grown. Most commercial plantings include only a few species from the genus *Pinus*.

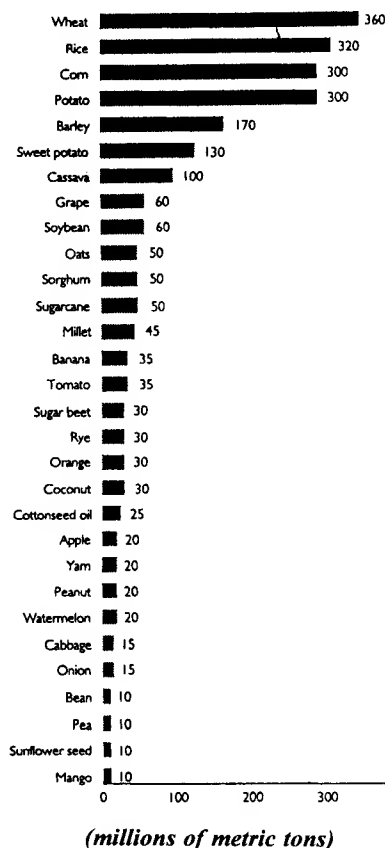
Among non-conifers one or two species of poplars and eucalyptus dominate.

(iii) Animal husbandry followed a narrowing course as well. Most of the world's 3,500 mammals and 9,000 birds—not to mention numerous reptiles and insects—have been trapped, snared, speared, netted, or grabbed for food at one time or another. But over the millennia only a couple dozen were domesticated, such as the turkey, duck, goose, water buffalo, horse, donkey, camel, and alpaca. Today almost all meat, milk, eggs, and other animal products come from just five animals: cattle, pigs, goats, sheep, and chickens.

## RESULT

Genetic narrowing in crop production, forestry, and animal husbandry is even greater than we realize because farmers have

*Annual production of crops that feed humanity*



selected individual specimens whose qualities stood out from the rest. For crops farmers have tended to save only seeds of elite plants. The subsequent harvest then provided slightly better food: roots became plumper, fruits sweeter, seeds quicker cooking, or vegetable leaves more tender. For livestock farmers bred types that gained weight faster, gave more milk or more wool, or were better at pulling carts or laying eggs. In some cases this age-old selection process has produced

the good-tasting, high-yielding, attractive crop varieties and productive livestock that we rely on for the bulk of our food. Horticulture depends on the same approach, cloning elite varieties such as red delicious

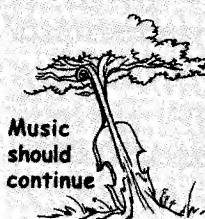
apples, for example. Forestry is moving in the same direction and is now starting to clone top-performing tree specimens.

In US all commercially sown maize

## BIODIVERSITY

*The number of species of plants and animals which inhabit the world may be anywhere from 2 to 80 million. As many as one million of these will be exterminated worldwide during the next two decades, many of which could be vital to the sustainability of life on earth.*

*There are several types of agricultural diversity. The large diversity of ecological microregions in India require in turn a large diversity of crops. In each species of crop, there are a large number of varieties that have been developed. Within each crop variety there is multiple diversity in resistance to water and temperature stress, pests, and so on. Within each farmer's plot, there are dozens of species of "weeds" and other plants. In hedges or in the fields themselves, there are innumerable species of micro-organisms, insects, and other smaller creatures, and dozens of larger mammals and birds, perhaps fishes. And there are species external to the field, on "wastelands", roadsides, and in forests, but all connected to that microregion, and affecting its agriculture. Traditional*



*systems ensured that habitats were available for all these creatures.*

*Plants, fungi, microbes and arthropods account for the bulk of species in many ecological regions. In one area sampled the fungi alone added to about 4000 kg/ha, the arthropods about 1000 kg/ha, while the mammals and birds contributed only 2 kg/ha and 0.03 kg/ha biomass, respectively.*

*Species diversity has been found to be positively correlated with the quantity of living and nonliving organic matter present in the ecosystem. In field tests in the former USSR, the species diversity of macrofauna (mostly arthropods) increased 16% when organic manure was added to wheat plots, while in tests in grassland in Japan, it more than doubled with manuring. In another example, a 100-fold increase in plant biomass productivity yielded a ten-fold increase in bird diversity.*

**- Winin Pereira**

comes from 6 strains, two-thirds of rice from four, half of all cotton from 3, half of wheat from 9 strains.

A handful of breeds dominate the world of animal husbandry. In US all beef comes from 2 varieties of cows, most of the milk from one. All broiler chickens are from 2 strains, half of world's turkeys come from one corporation.

### **INCREASING VULNERABILITY**

All this adds to the danger from diseases and pests. Unnatural domesticated species are in greater risk. The transformed plants are chosen for their tender and special quality, losing their hardiness, ruggedness. Protective features such as hard leaves, small seeds bad flavour are being lost to nature. Uniformity of domesticated species enhances danger. A small outbreak will explode into a catastrophic epidemic and devour all the primary production that keeps humanity fed.

Apart from danger of diseases, desire for varieties in agriculture makes the farmers preserve the resources needed for diversification. Agriculture is forced to change and adjust because of 1) emerging technologies 2) consumer preferences 3) rising fuel prices 4) alteration in pricing policies 5) climatic change. A narrowed genetic base reduces the options for adapting to change.

The ability of agricultural and pastoral systems, to adjust to change and meet the ever increasing demands for food and other agricultural products thus hinges on the availability of a broad range of plant and animal resources. Only when the integrity of this genetic safety net is assured, can agriculture remain productive and resilient in the face of unexpected shocks. In the history of the world such shocks have been frequent, intense and cruel from man's point of view.

### **SHOCKS IN AGRICULTURE**

**1. Wheat :** Grainlosses, famines, downfall of whole societies are recorded in the Middle East History. Even today diseases, viruses etc. are surviving. In 1904 stem rust epidemic destroyed almost all the wheat crop in the U.S. In 1907 a rust destroyed so much of wheat forcing the Government to institute wheatless days for the public. In 1943 wheat crop failure in Eastern India killed a million people.

**2. Rice :** In Indonesia in 1980, a pest became resistant to all insecticides threatening to wipe out all of Asia's hard-won selfsufficiency in rice.

**3. Potato :** In 1846 Ireland's potato fields were threatened by fungal infection. Even today 12 such fungi exist.

**4. Cassava :** A mealy bug in Africa threatened the 34 countries in Africa, involving 200 million people who eat cassava as the main food. The yields came down to 60% of the normal.

**5. Citrus :** In 1985 a citrus canker killed 12 million orange trees in US, Florida.

**6. Banana :** A fungal plague originating in Fiji is threatening the entire banana crop of the world; banana is the world's most popular fruit.

**7. Forestry :** The risk inherent in depending upon a few cloned varieties is great. In France a single poplar clone grown throughout the country recently succumbed to diseases. Newzealand had a similar experience in 1980s. To save the large pine plantation vital for the national economy of Newzealand, a military type operation had to be mounted. The danger was from pests. South America and South East Asia had similar problems for their rubber plantations, all of which depend upon just eight cloned varieties.

## BIODIVERSITY DEFENCE

Painful collapses of agricultural and forestry yields have taught researchers, that to neglect diverse genes source is to endanger humanity. Biodiversity is a sort of immune system husbanded by previous

generations. To pass it on undiminished ...is each generation's charge.

Agricultural biodiversity encompasses the genetic foundations that support every type of land use: 1) field farming 2) horticulture 3) pasturing 4) aquaculture etc. And biodiversity underpins much more than food resources. Cultivated plants provide humankind with wood, paper, rubber, resins, dyes, medicines, insecticides, etc. In fact, their biodiversity sustains most things in our lives, food, clothing, shelter, etc.

As farmers are attracted to narrower bases of higher yielding and other premium varieties bred by modern science, older varieties are being lost. More and more Third World farmers are abandoning conventional varieties. Today a variety is a premium one, tomorrow it is gone. Even in the wild, varieties are being lost every day. In future, we may not get specific genes when we need them.



As high-yielding premium varieties attract the farmer, older varieties are being lost.

## VITAL CRADLE REGIONS

Sites where crops emerged from the

wild are particularly important sources of disease and pest resistance. They still retain an array of ancestors and relatives. Eg.

| Sl. No. | Area                | Crop                     |
|---------|---------------------|--------------------------|
| 1.      | Afghanistan, Turkey | Wheat, rye, pea, apple   |
| 2.      | China               | Soyabeans                |
| 3.      | S.E. Asia (India)   | Rice, Sugar-cane, Banana |
| 4.      | Mexico, Carribean   | Maize, Sweet potato      |
| 5.      | S.America           | Pineapple                |

Most cradle regions are in the developing world, into which scientists dipped their nets and saved food supplies in every nation of Earth. Ireland's potato was saved by a wild potato from Mexico.

| Sl. No. | Endangered Crop                       | Saviour Crop Wile            |
|---------|---------------------------------------|------------------------------|
| 1.      | American Maize                        | Nondescript Mexican maize    |
| 2.      | S.E.Asian Rice                        | Wild rice from Asia          |
| 3.      | California's 160 m.dollar Barley crop | A barley plant from Ethiopia |
| 4.      | Commercial tomato                     | Wild varieties from Peru.    |
| 5.      | Banana industry of America            | A Saigon variety             |

The presence of uniform crops laid out in massive blocks can induce pest and disease outbreaks on a global scale. Man's attempts to thwart them through

## BIODIVERSITY AND THE TROPICS



**Listen**

Conservation and management of biodiversity is particularly critical in lower latitudes because they contain infinitely more species than typically found in temperate areas. Agro-biodiversity is also exceptionally high in the humid tropics. Tropical rainforests cover only 7 percent of the earth's surface but are home to more than half of the world's biota. A couple of specific examples illustrate the extraordinary levels of biodiversity found in tropical rainforests and underscore their importance for conservation and the need for careful management of their biological riches. A 13.7 Km<sup>2</sup> portion of the La Selva reserve in Costa Rica contains almost 1,500 plant species, more than are found in all of the United Kingdom. The Malayan Peninsula is only about a third as large as the United Kingdom, but it contains five and-a-half times as many plant species. Throughout geological history the tropics have been a major source of evolutionary novelty, not simply a refuge that has accumulated diversity because of low extinction rates (Jablonski 1993). Tropical forests contain wild populations of hundreds of crops, such as mango, coffee, and rubber, as well as candidates for new crops and livestock. The loss of tropical forests also forecloses on options for future agricultural development. Humankind has a collective responsibility to ensure that such novelty is available for future generations.

1) quarantine 2) plant breeding 3) biocontrols and 4) synthetic pesticides are beginning to fail.

Increasing population, food need and degrading lands have added to the significance of biodiversity as a last refuge for food security.

## THE CHANGING SCENE

Luckily, appreciation for bio-diversity, importance of returning to Nature, disenchantment with chemicals etc. are the new trends. This holds promises of better concern for sustainability. The biodiversity riches of the developing world are being appreciated more and more. Fruits, vegetables, grains, roots, tubers, hitherto unsorted, unquantified, and undetermined, are still feeding millions of people in Africa, Asia and Latin America.

There is a certain bias against the food crops of the tropical areas. The Research Centres are concentrated in the temperate zones. Some food crops are ignored because they are considered poor people's plants. But market diversification, taste for new fruits, and modern technologies like chilled air-freight are promoting the sales and marketability of rare varieties. The pharmaceutical industry is also returning to natural products. Greater recognition of sustainability as opposed to just productivity

has created new opportunities for ignored plants. Waste water treatment through weeds, land stabilization through hedges, soil restoration through legumes, pest control through the neem tree, water clarification through the seeds of Moringa tree, controlling global temperature through tropical trees, health care through medicinal plants, etc. go to prove the impact of change.

Biodiversity is used for integrated pest management. Spiders in China, wasps in Africa, geese in the West, duck in Canada, wild ducks in America are examples of integrating biodiversity with pest management. Pests also can be turned into resources. Deers and rabbits in Newzealand, Quelea in Africa, Armadillo in America, Possum in Australia, were pests destroying forests. They were exploited in a controlled manner for supplying meat.

Wild animals contribute 60% to 80% of the diet in Ghana, Zaire, Liberia and Botswana.

Brazil gets a sizeable protein supply from wild animals. All these have not come under the sight of Western science. African and Latin American countries are domesticating newer animals for meat. Ostrich in Australia, yak in Canada, bison in America, alpaca and llama in America are animals and birds that have found new homes. Savers of old breeds of livestock,



Listen

**PROBLEM**

Eighty per cent of the world's biological resources exist in the forests of the South. The North wants unrestricted access to this biodiversity as it is fodder for their pharmaceutical and biotechnology companies. Most big companies are based in the US, where the retail value of drugs derived from plants by pharmaceutical companies is approximately US \$ 43 billion a year.

Unless tropical deforestation is slowed immediately, about 60,000 of the world's 240,000 plant species could become extinct by the year 2020. Meanwhile, indigenous communities rarely profit from the use of their biodiversity or the traditional knowledge associated with it.

**- Down to Earth, March 2000.**

and seed savers are arranging themselves in groups to protect the endangered species.

The world as a whole neglects agro-biodiversity. But large areas in Latin America, Asia and Africa continue biodiversity-friendly farming methods. Economic cultivation of endangered species has saved varieties. Crocodiles, butterflies, deer and heavy birds are reared in Papua, New Guinea, to combine biodiversity preservation and commerce.

Global problems such as hunger, malnutrition, deforestation, desertification,

soil loss, and soil degradation can be combated by making use of fruits, vegetables, trees, unknown to western science.

**CONCLUSION**

All this will call for preservation of genesites, quick assessment of agro-biodiversity, diversified marketing, economic policy to enhance biodiversity, and proper water-shed management.

A strategy for harmonizing biodiversity conservation with agricultural development is a vital necessity if habitat protection is to transcend the needy and the greedy. Only when plants and animals are of local value will they and their habitats have a chance to survive. The fact that the protected lands of the tropics enclose the ever evolving genes for the global future can breathe new immediacy and new energy into the funding, functions, and the raison d'être of protecting the environment. In the foreseeable future no other option is open if our complex and rapidly growing population is to be fed, clothed and housed reasonably, inexpensively, pleasantly, and safely. In sum, biodiversity holds the key to the future of world food production and to the long-term success of wild life conservation.

***From : Biodiversity and Agricultural Intensification.***

## BIODIVERSITY

India's natural diversity is one of the richest in the world. But now it is endangered. Wheat, rice varieties are



Our natural diversity, which is the richest in the world, is now endangered.

disappearing. Tree, cattle, buffaloes, goats, pigs, camels, ducks, fish varieties are dwindling.

In 1950's Indian farmers cultivated 50,000 varieties of rice. In 2000 it may come down to 50 varieties.

A single sample of wild rice collected from Eastern U.P. in 1963 could help Asian farmers save 30 million hectares of paddy from grassy stunt virus a dreaded disease

maker. That is the order of saving (or loss) we are considering when each variety is lost or identified.

Silent valley in Kerala, revealed nine species of an entire genus of plants not known to science. Luckily the valley was saved from "developmental" invasion.

High yielding milch animals brought to towns from villages are killed during dry periods frustrating the entire process of milch animal upgradation. High yielding varieties are steadily disappearing. Buffaloes now yield about one tonne of milk lesser per every lactation period than their ancestors 60 years ago.

We kill frogs by tonnes for export. Mosquitoes and crop pests multiply as a result. Tigers are on the verge of extinction.

Four weeds, lantana, parthenium, eupatorium and water hyacinth flourish at menacing rate.

The wild life policies are state dominated. People have no role to play in managing them, their habitats and resources.

Communities dependent upon forest resources suffer for want of permission to enter reserved areas. Their traditional rights are getting eroded. Alternative livelihood creation and rehabilitation are inadequate or down right unfair.



**Government taxes the people for biodiversity conservation. People are neither involved nor do they benefit.**

Government taxes the people for biodiversity conservation. People are neither involved nor do they benefit.

### INDIA'S LIVING WEALTH

In percentage of world total (number) (world total in brackets) :

|                  |                          |
|------------------|--------------------------|
|                  | Total 6.67 % (1,217,645) |
| 1. Amphibia      | 3.95% (5145)             |
| 2. Protochordata | 5.34% (2173)             |
| 3. Arthropoda    | 6.13% (983,677)          |
| 4. Mollusca      | 7.59% (66,535)           |

|                        |                 |
|------------------------|-----------------|
| 5. Reptilia            | 7.85% (5,680)   |
| 6. Mammalia            | 8.03% (4,629)   |
| 7. Protista            | 8.23% (31,290)  |
| 8. Other invertebrates | 9.56% (87,121)  |
| 9. Pisces              | 11.72% (21,723) |
| 10. Aves               | 12.7% (9,672)   |

### ENDEMIC SPECIES OF ANIMALS/PLANTS

#### Animals total 1837 species

|                |             |
|----------------|-------------|
| 1. Lepidoptera | 9 species   |
| 2. Mammalia    | 37 species  |
| 3. Aves        | 50 species  |
| 4. Pisces      | 78 species  |
| 5. Amphibia    | 85 species  |
| 6. Reptilia    | 152 species |
| 7. Protozoa    | 619 species |
| 8. Mollusca    | 807 species |

#### Plants 5,150

|              |              |
|--------------|--------------|
| Angiosperms  | 4950 species |
| Pteridophyte | 200 species  |

#### India's Protected Parks

|                |      |      |
|----------------|------|------|
|                | 1980 | 1997 |
| National parks | 19   | 80   |
| Wildlife parks | 205  | 441  |

The world has 392,700 species of micro organisms, and plant species. India has 49,219 species of them or 12.53%.

The world has 1,217,645 varieties of animal species. India has 81,251 or 6.67% of them.



### GENETIC DIVERSITY

It is estimated that between 50-100 species of plants, animals and organisms are becoming extinct **DAILY**. At this rate we will have eradicated 1/3 of known species by the year 2010. A recent report stated that every life form studied was in decline.

*-Alan Herbert*

### NUMBER OF WILD RELATIVES OF CULTIVATED CROPS

| Crop  | No. of wild relatives |
|---|-----------------------|
| 1. Coffee, oil seeds, sugarcane, tea, tobacco | 12                    |
| 2. Fibre crops                                | 24                    |
| 3. Fruits                                     | 104                   |
| 4. Medicinal plants                           | 3000                  |
| 5. Millets                                    | 51                    |
| 6. Spices/condiments                          | 27                    |
| 7. Vegetables pulses                          | 55                    |

### INDIA HAS DOMESTICATED ANIMAL VARIETIES

| Animal     | No of species |
|------------|---------------|
| 1. Buffalo | 8             |
| 2. Camels  | 8             |
| 3. Cattle  | 27            |

|            |    |
|------------|----|
| 4. Donkeys | 2  |
| 5. Goats   | 22 |
| 6. Horses  | 6  |
| 7. Poultry | 18 |
| 8. Sheep   | 40 |

### FISH DIVERSITY

| Ecosystem         | No of species | Percentage of Total |
|-------------------|---------------|---------------------|
| 1. Fresh water    | 73            | 3.32%               |
| 2. Warm water     | 544           | 24.73%              |
| 3. Brackish water | 145           | 6.50%               |
| 4. Marine water   | 1440          | 65.45%              |
| Total             | 2202          | 100                 |

### ENDANGERED BIODIVERSITY 1995 POPULATION

|                      |            |
|----------------------|------------|
| Tigers               | 3750 only  |
| Rhinoceros           | 1498 only  |
| Leopards             | 6828 only  |
| Elephants            | 25000 only |
| Lions                | 304 only   |
| Brown antelope, Deer | 152 only.  |

### THREATENED PLANT SPECIES

|                                    |      |
|------------------------------------|------|
| No. of species that are threatened | 1500 |
| No. surveyed                       | 633  |
| Extinct                            | 33   |
| Endangered                         | 157  |
| Vulnerable                         | 114  |
| Rare                               | 246  |
| Indeterminate                      | 1    |

|                      |   |
|----------------------|---|
| Insufficiently known | 2 |
| Out of danger        | 0 |

### DOMESTICATED ANIMAL SPECIES THREATENED

|    |        |    |                      |
|----|--------|----|----------------------|
| 4  | out of | 8  | breeds of Buffaloes. |
| 16 | out of | 19 | breeds of cattle.    |
| 4  | out of | 20 | breeds of goats.     |
| 14 | out of | 38 | breeds of sheep.     |

### INDIA'S RANKING IN GERMPLASM COLLECTION

| Crop         | Ranking | Percentage of world's total accession |
|--------------|---------|---------------------------------------|
| 1. Brassica  | 1       | 16                                    |
| 2. Cotton    | 1       | 34                                    |
| 3. Maize     | 2       | 10                                    |
| 4. Groundnut | 2       | 20                                    |
| 5. Sugarcane | 2       | 22                                    |
| 6. Rice      | 3       | 12                                    |
| 7. Wheat     | 4       | 6                                     |
| 8. Lentil    | 6       | 3                                     |

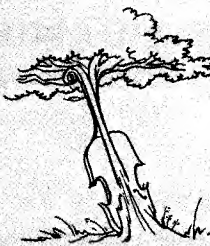
In India's national germplasm collection, the following genes are preserved :

1. Cereals, pseudo cereals
2. Millets
3. Oil seeds
4. Pulses
5. Vegetable spices
6. Medicinal / aromatic plants.

### RICH ANIMAL GERMPLASM BASE

*The Indian sub-continent is markedly rich in livestock and poultry wealth. In terms of diversity, variety and utility, hot and humid tropics are a veritable gold mine of farm animal and poultry germplasm resources. Economically useful animal germplasm includes numerous breeds of cattle, buffalo, sheep, goat, poultry, ducks, geese, pig, camel, horse, mule, donkey, mithun and yak. India possesses 11% of all the recognised cattle breeds and almost all the recognised buffalo breeds of the world. Its world share of goat and horse breeds is 33% and 17%. Several complex and interactive factors like human needs, adaptability of a species, agroclimatic conditions, selection and animal husbandry practices are involved in the emergence of a breed. Each breed / type should be regarded as a collection of special genes designed to serve specific purpose(s), in particular agro-ecological zones and a distinct genetic resource.*

*Presently, India has the best breeds of dairy, draught and dual-purpose cattle adapted to the tropics. The world's best breeds of buffaloes, carpet-wool sheep and fast-breeding goats are available in this country. In spite of such a large number of descript breeds, 75% of the live-stock are nonde-script.*



- D.S. Balain

Music should continue

## BIODIVERSITY MILESTONE

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### WE TOOK A LONG TIME TO DEVELOP OUR BIODIVERSITY AND OUR MINDS

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|             |   |
|-------------|---|
| 4 Billion   | years ago: single celled organism appear in the sea.  |
| 3 Billion   | years passed before large multi cellular life evolved.  |
| 540 million | years ago. Life in seas; Animals with skeletons and shells developed.   |
| 440 M.Y.A.  | FIRST GREAT MASS EXTINCTION.<br>MANY MARINE GROUPS WIPED OUT.   |
| 425 M.Y.A.  | Vegetations, animals occupy land.   |
| 415 M.Y.A.  | insects appear on land.   |
| 370 M.Y.A.  | Another mass extinction 70% of marine animal species perish.  |
| 30 M.Y.A.   | Reptiles evolve; become first vertebrates to live independently on Land.  |
| 250 M.Y.A.  | Permian Mass Extinction, 90% Animals wiped out.<br>Mammal like animals survive. Mammals evolve.                     |
| 230 M.Y.A.  | Dinosaurs.  |
| 210 M.Y.A.  | Mammal like reptiles die.   |
| 150 M.Y.A.  | Animals with teeth, feathers, claws, appear; Bird appears.  |
| 130 M.Y.A.  | Flowering plants.   |
| 65 M.Y.A.   | Dinosaurs Extinct in Mass.<br>A meteorite hits earth changes climate; mammals proliferate.                          |
| 4 M.Y.A.    | Apes walk on two feet.  |
| 100,000 YA  | Modern Hominid.   |
| 11,000 YA   | Large mammals extinct hunted.   |
| 350 BC      | Aristotle classifies animals.   |
| 400 AD      | Flightless birds of Hawaii die.   |
| 1400-1500   | Inter continental exploration/trade hasten exchange of animals, plants, microbes, dooming native species.           |
| 1500-1600   | Europe's forests depleted.  |
| 1600-1700   | Settlers clear America's forests habitat loss will kill 500 plant/animal species.                                   |
| 1700-1800   | 1753 Carl Linnaeus creates system of naming flora, fauna.<br>Naturalist sails round the world increasing knowledge. |
| 1800-1900   | Charles Darwin. Origin of species—how new species arise.  |
| 1866        | Word ecology coined.  |
| 1872        | Protecting Nature First step.   |
|             | Earth population goes up by 70% to 100 crores.  |
| 1900        | One fungus in North America affects billions of chestnut trees.   |
| 1960        | Tropical forest clearing large scale extinction.  |
| 1973        | Legal measures to protect endangered species.   |
| 1977        | A new domain of life—Archaea discovered.  |

The planet's sixth great mass extinction in progress.

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## MONOCULTURES OF THE MIND

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VANDANA SHIVA

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### INTRODUCTION

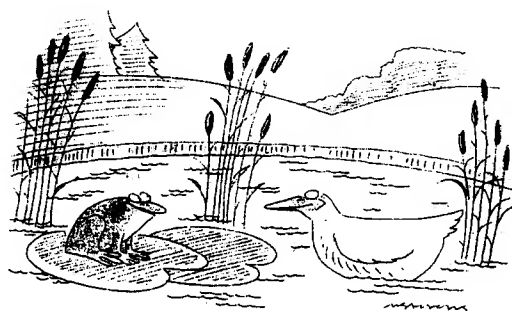
**T**he main threat to living with diversity comes from the habit of thinking in terms of monocultures; from what I have called 'Monocultures of the Mind'. Monocultures of the mind make diversity disappear from perception, and consequently from the world. The disappearance of diversity is also a disappearance of alternatives - and gives rise to the TINA (there is no alternative) syndrome. How often in contemporary times total uprooting of nature, technology, communities and entire civilisation is justified on the grounds that there is 'no alternative'. Alternatives exist, but are excluded. Their inclusion requires a context of diversity. Shifting to diversity as a mode of thought, a context of action, allows multiple choices to emerge.

### GROUND WORK

Experience with the impoverished and impoverishing nature of monocultures was associated with an ecological audit of eucalyptus plantations. especially in the

semi-arid zones of Karnataka state where a World Bank social forestry programme was leading to the erosion of farm diversity and a consequent erosion of water and soil, livelihoods and supply of biomass for local use. In 1983, the farmers' movement, the Raitha Sangha, started to uproot eucalyptus seedlings in forest nursery and substitute them with seedlings of diverse species like mango, tamarind, jack fruit, pongamia, etc.

A later study of the Green Revolution in agriculture showed that it was primarily a recipe for the introduction of monocultures and the destruction of diversity. This was also linked to the introduction of centralised control of agriculture and the erosion of



"My lawyer finally got me on the endangered-species list".

decentralised decision making about cropping patterns. Uniformity and centralisation made for social and ecological vulnerability and breakdown.

Biotechnology and the gene revolution in agriculture and forestry threaten to worsen the trends towards erosion of diversity and centralisation that began with the Green Revolution.

It is in this context of the production of uniformity that the conservation of biodiversity needs to be understood. Conservation of diversity, is, above all, the production of alternatives, of keeping alive alternative forms of production. Protecting native seeds is more than conservation of raw material for the biotechnology industry. The diverse seeds now being pushed to extinction carry within them seeds of other ways of thinking about nature, and other ways of producing for our needs. The critical theme in all the papers is that uniformity and diversity are not just patterns of land use, they are ways of thinking and ways of living. The essays also address the myths that monocultures are essential for solving problems of scarcity and there is no option to destroying diversity to increase productivity. It is not true that, without monoculture free plantations there will be famines of fuel wood, and without monocultures in agriculture there will be famines of food. Monocultures are in fact a

source of scarcity and poverty, both because they destroy diversity and alternatives and also because they destroy decentralised control on production and consumption systems.

Diversity is an alternative to monoculture, homogeneity and uniformity. Living diversity in nature corresponds to a living diversity of cultures. The natural and cultural diversity is a source of wealth and a source of alternatives.

### **IT STARTS FROM THE MIND**

Monocultures first inhabit the mind, and are then transferred to the ground, Monocultures of the mind generate models of production which destroy diversity and legitimise that destruction as progress, growth and improvement. From the perspective of the monoculture mind, productivity and yields appear to increase when diversity is erased and replaced by uniformity. However, from the perspective of diversity, monocultures are based on a decline in yields and productivity. They are impoverished systems, both qualitatively and quantitatively. They are also highly unstable and non-sustainable systems. Monocultures spread not because they produce more, but because they control more. The expansion of monocultures has more to do with politics and power than with enriching and enhancing systems of biological production. This is as



true of the Green Revolution as it is of the gene revolution or the new biotechnologies.

### **BIOTECHNOLOGY : BOON OR BANE?**

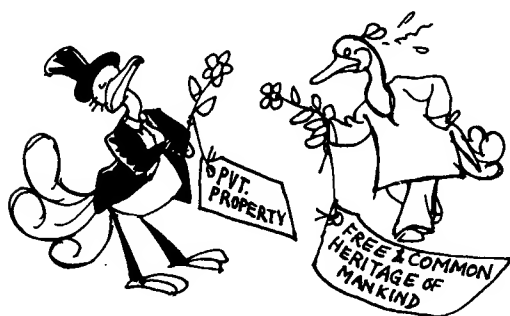
Negotiation on biodiversity cannot be separated from negotiations on biotechnology. They argue that the treatment of biodiversity as mere 'raw material' comes from an anti nature and racist stand point which treats nature and Third World people's labour as valueless. Biodiversity does not merely get value through biotechnology and genetic engineering performed by 'white men in white lab coats' to quote Pat Mooney. It has intrinsic value and also a high use value for local communities. The paper also sounds a caution against the treatment of biotechnology as an ecological miracle, and a solution to every environmental ill. Biotechnology could be unleashing worse ecological problems that it claims to solve. There is also a deep and unjustified use of power and politics involved in treating biodiversity and its produce as a free and

common heritage of mankind when it comes from the Third World, while treating the products of the same biodiversity as patented private property when it is slightly modified in the labs in the North. Diversity as a way of thought would allow a fairer and more just treatment of the contributions of the North and South.

### **BOTH BIOLOGICAL AND POLITICAL**

We argue against the distorted notions of obsolescence of living bio-diversity inherent to the paradigm of monocultures which goes hand in hand with monopoly rights over the control of biodiversity and threatens us with unanticipated disasters in the form of the gene revolution. The native seed becomes a system of resistance against monocultures and monopoly rights. The shift from uniformity to diversity is essential both ecologically and politically. It is an ecological imperative because only a system based on diversity respects the rights of all species and is sustainable. It is also a political imperative because uniformity goes hand in hand with centralisation, while diversity demands decentered control. Diversity as a way of thought and a way of life is what is needed to go beyond the impoverished monocultures of the mind.

*From : Monocultures of the Mind,  
Natraj Publishers, Dehradun, 1993.*



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## BIODIVERSITY, POVERTY AND INTELLECTUAL PROPERTY RIGHTS

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ANIL K. GUPTA

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**B**iodiversity in the Third World is fast depleting as an inevitable consequence of modernisation. It is depleting in high growth regions as well as slow or negative growth regions. In the former case, agribusiness has provided opportunity for short-term non-sustainable growth spurred by CGIAR centres. In the latter case, lack of alternative technology, declining demand for their products, continued exclusion by market forces and poor political articulation have combined to produce a very adverse economic environment. The cycle of drought, floods, cyclones, etc., further impair their resilience. Under the circumstances, a set of bold initiatives is called for.

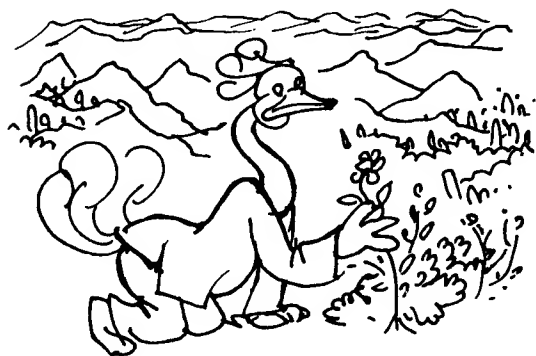
Several modern technologies, including DNA fingerprinting, recombinant DNA, tissue culture, etc., have generated a false hope that genetic diversity can be preserved entirely by laboratory methods. I do not share this optimism. In my view, bio-diversity is not a static concept. People living in bio-rich and economically poor environments keep on making selections of one kind or the other to enrich the given diversity; therefore the need for institutional mechanisms that

safeguard the ability of these people to continue the process of enriching biodiversity. The fact that most of the poor people in these environments have to migrate seasonally or permanently to cities or other high-growth rural regions proves that most countries do not value biodiversity properly. In view of the unequal terms of exchange and misguided tariff and tax policies, most developing countries have a very precarious balance of payments position. They are dependent upon developed countries. The elite in developing countries aspire for the same lifestyle that their counterparts in developed countries enjoy. The policy planning system is often manned by the same elite. Thus it is not going to be an easy task to reorganise the institutional and policy framework to sustain biodiversity.

At the same time there is a global concern that something has to be done to prevent very fast loss of genetic diversity. I have argued in this paper that the persistence of poverty in the bio-rich regions is not accidental. It clearly shows the low value that various national and international bodies place on the efforts made by local people in

producing and reproducing this biodiversity. This is not a technical problem alone. It affects the whole political economy or political ecology of generating wealth through the agribusiness approach of standardisation in agriculture.

The sustainability of this approach is being questioned even in the developed world. But most of the developing countries have still to realise the value of what they possess. It is not being sufficiently realised that the genes for disease resistance, stability and survival in harsh environment are



The genes for disease resistance, stability and survival in harsh environment are available only in the tropical, Himalayan and Andean environment.

available only in the tropical, Himalayan and Andean environment. If global climatic changes are likely to be even half as serious as these are being made out to be, the skills of reproducing biodiversity under harsh conditions are going to be in great demand. I would not be surprised *if the pastoralists, forest people and the mountain communities become the dominant*

*cultures. But the global efforts do not have to await that inevitable eventuality.*

Once we have found a satisfactory way of conducting a discourse on biodiversity, I think we would have also discovered a way of operationalising our concerns through grassroots oriented action plans.

The disadvantaged communities have become a source of cheap 'unskilled' labour for infrastructural projects. The National Commission on Development of Backward Areas in fact went to the extent of cautioning against too much effort in stemming migration from the backward regions, lest the supply of cheap labour is affected adversely. Such a perspective is at the root of the problem.

During a very severe drought in 1987, about 20 lakh cattle and their rearers were in the cattle camps of varying quality. Even though an effort was made to catalogue the good breeding bulls at our insistence nothing much came of it.

If we believe that research on building sustainable institutions cannot be pursued in a meaningful manner without building upon indigenous ecological knowledge, then the involvement of people in the research process itself would be most necessary. The findings of research must be shared with the people from whom data have been collected,

not only ethical reasons but also for scientific reasons. Only when indigenous groups take note of, our explicit acknowledge-ment of our inadequacy will they offer to share with us insights and ideas that in the normal course do not make sense.

The major contention here is that traditional knowledge comprises several building blocks such as: historic repertoire of risk adjustment options, evolution of ethical norms justifying management of resources individually or collectively, concept of knowledge as common property and development of an appropriate communications system, a peer group for appraisal of innovations, experimentation and revalidation of certain technological or institutional solutions. In some cases, the innovations emerge because collective survival is given precedence over individual survival. In other cases, innovations may be a consequence of serendipity, thoughtful evolution, amalgamation of traditional and modern materials and norms.

Biodiversity is the outcome of creativity, triggered by cultural institutions and an indigenous knowledge system. What weight this creativity of disadvantaged people inhabiting these highly biodiverse regions should place

on our conscience is the issue to be explored.

We have suggested challenging opportunities that are available before the concerned leaders, NGOs, scientists and citizens of developed countries. It is a struggle in which the North-South divide has to be overcome. We are passing through an era of global reconciliation. The debate on conserving biodiversity presents a unique opportunity to us to recognise the contribution of previous generations which bequeathed a biodiverse world to us. The debt of communities which are maintaining biodiversity by themselves remaining poor is even higher. But we should not expect these communities to maintain biodiversity by bearing deprivation indefinitely. The product of their knowledge — the landraces — cannot be treated as a part of global heritage simultaneously granting private rights to breeders in large companies. I have argued in this paper that compensating these creative people of the Third World is not only possible but is imperative if biodiversity is to be maintained in the future.

**Source : *Biodiversity Implications for Global Food Security*, Ed. by M.S. Swaminathan & S. Jana, Macmillan India Ltd., Madras, 1992.**

## A STRATEGY FOR MAINSTREAMING BIODIVERSITY IN AGRICULTURAL DEVELOPMENT

JITENDRA P. SRIVASTAVA, ET AL

A strategy is needed to reconcile the task of preserving biodiversity while at the same time increasing agricultural productivity. The expansion of agricultural frontier, population growth, and an emphasis on maximising agricultural output using potent agro chemicals are exerting pressure on habitats for wild plants and animals. Conversion of wild life habitats and adoption of modern farming practices that rely heavily on purchased fertilizers, pesticides, and herbicides, trigger a loss of biodiversity and the extinction of species. This occurs more in developing countries where most of the earth's biodiversity is located than elsewhere. For this end, policies and practices that promote biodiversity conservation are to be adopted.

- 1) Commitment to enhance biodiversity in agriculture should have the following objectives :
  - a) Government commitment for mainstreaming agro biodiversity.
  - b) Farmer's commitment to incorporate greater diversity in farming systems.

For this end, inter governmental dialogue, property rights for farmers, better training and research are proposed by the World Bank.

- 2) There has to be a new agricultural research and extension paradigm with increased participation of farmers, conscious deployment of diversity, improved productivity even in marginal environments, creating awareness, and creating landscape mosaics with habitats for wild life and cropland. For this end the World Bank proposes to promote active participation of farmers in research policy, support the development of polygenic resistance, multilines, high-yielding, open-pollinated varieties instead of hybrids.
- 3) Conservation of agrobiodiversity through appropriate balance between *in situ* and *ex situ* approaches, promote in situ conservation of crop and livestock genetic resources and maintain materials in *ex situ* collections recognizing their future

### HOLISTIC APPROACH TO BIODIVERSITY CONSERVATION

Protection of a sample of natural habitats is neither sufficient nor desirable for conserving biodiversity for two simple reasons : most of the world's biodiversity exists in human-managed or modified systems, and land-use pattern and sociopolitical factors in areas adjacent to parks and reserves have major implications for the integrity of biological diversity in "protected" areas.



This relationship has clearly been demonstrated by the fate of sixty-two bird species in an 86-hectare woodland in West Java. After several square kilometers of surrounding woodland were destroyed, twenty bird species disappeared, four declined almost to extinction and five more declined noticeably. The remaining species appeared to be unaffected. This example highlights the need for regional conservation, and the need for integration of biodiversity conservation for both protected areas and agricultural ecosystems.

economic value. To this end the World Bank proposes to evaluate *in situ* conservation, restudy intellectual

property rights applicable to traditional varieties to benefit local people.

- 4) Approaches to *in situ* conservation of crops and livestock.
  - i) Maintaining parks and reserves safeguarding plants and animals for the future improvement of agriculture.
  - ii) Creating world heritage sites for resources for agricultural development.
  - iii) Protecting sacred sites and agrobiodiversity.
  - iv) Integrating agrobiodiversity with eco-tourism.
  - v) Helping to find markets for lesser known crops "use it or lose it".
  - vi) Helping to find ways for livestock owners to generate more revenues from threatened breeds.
- 5) Greater involvement of the private sectors through market diversification and engaging private land owners in the conservation and management of biodiversity.
- 6) Tapping indigenous knowledge on :
  - i) Crop varieties adapted to harsh growing conditions.
  - ii) Cropping patterns that minimise diseases.
  - iii) Breeds of livestock that tolerate

- poor feed or resist diseases and pests that afflict imported breeds.
- iv) Knowledge of botanical resources that leads to plant domestication. The above work should be done within the naturally protected cultural milieu.
- 7) Increasing the support for systematic studies of basic Botany and Zoology with bio-diversity in mind.
- 8) Creating agrobiodiversity assessment teams to study :
  - i) Shifting boundaries of different land use systems
  - ii) Undisturbed habitats and
  - iii) Agrobiodiversity.
- 9) Developing performance indicators:
  - i) Natural habitat loss.
  - ii) Habitat fragmentation.
  - iii) Species loss (habitat intact).
  - iv) Decline in biodiversity of species on farms.
  - v) Decline in biodiversity within species.
  - vi) Minimizing habitat fragmentation by providing wild life corridors along bridges of natural habitat.
  - vii) Integrated pest management through crop rotation and bio control.
- viii) Eliminating legal measures that promote homogeneity.
- 10) Policy environment can be improved by promoting quality pricing/opening credit to rare varieties and discouraging farming subsidies.

## CONCLUSION

In this manner, agricultural development can host biodiversity through:

- i) Integrated pest management.
- ii) Participatory approach with local farmers.
- iii) Use of indigenous knowledge.
- iv) Study of lesser known crops and animals.
- v) Awareness of the value of a mosaic of land uses.
- vi) Promoting diversity of habitats within land use systems.
- vii) Greater recycling organic matter.
- viii) Studying life time and herd productivity characteristics instead of individual traits.
- ix) Documentation of resources for conservation and breeding.

***From : Biodiversity and Agricultural Intensification.***

## **SUSTAINING BIODIVERSITY**

**VANDANA SHIVA, VANAJA RAMPRASAD, RADHA HOLLA BHAV**

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### **INTRODUCTION**

**F**or millennia farmers have studied, identified, modified, cultivated and exchanged seeds freely. They had a knack for recognising what is best nutritionally, tastewise, and for other specific purposes. In this sense a farmer is always a scientific plant breeder. They conserve and develop this diversity through cultivation of the varieties.

As the farmer produced mainly for the family, the village and then the rest of the world, with the main vision being sustainability of both lifestyle and nature (including land and water resources) it was in his interest to conserve the plant varieties developed by him.

### **DIVERSITY AND SUSTAINABLE AGRICULTURE**

Genetic diversity is essential in Agriculture for developing plants with characteristics to suit ecological conditions, nutritional needs and other uses by farmers and for conferring at least partial resistance to diseases.

Hence the concern for us is to understand Biodiversity in its totality and not just in terms of food crops alone'. There exists a sympathetic relationship in the ecological niche in which crops grow. Diversity plays an important role in nutrient cycling, controlling insect population and plant disease. Therefore on field conservation of all diverse plant wealth is imperative for Sustainable Agriculture.

### **IMPORTANCE OF DIVERSITY**

Crop plant diversity has the following advantage of i) does not disturb land ii) it gives a green cover to the ground iii) it promotes water nutrient conservation iv) there is an annual perennial relationship between animals and trees v) some plants rob nutrients; some over produce them vi) assimilation of nutrient is better vii) abundance and increased efficiencies of natural enemies of plant parts viii) varieties within the same crop develop resistance to diseases. ix) it reduces weed population x) productivity increases xi) sustainability improves.



## LOSS OF CONTROL BY THE FARMER

The conventional hold of farmers on biodiversity was weakened as we lost out in the market economy in production of grain as well as seeds. People with profit as the only motive drove the farmer out of his domain.



Loss of control by the farmer

To enable this interference by non-farmers, the words denoting biodiversity were defined in a manner that went against recognising the farmers role in developing Biodiversity. This is pure politics.

- i) Farmers' varieties are called land areas as if they are gifts of nature produced without (farmers') human intervention.
- ii) The term variety does not refer to the farmers' handiwork. It refers only to new, distinct, uniform, stable types which are to be protected.
- iii) Germplasm refers to genetic material within the seed as if the various components of a seed/plant/ecology can be treated in isolation without emphasising their inter dependence.

- iv) Productivity does not take the input/output ratio.

All the above said factors have combined to attempt displacement of Biodiversity by monocultures. (Single variety usually sown over large areas).

## NEW BIOTECHNOLOGIES

(1) Tissue Or cell culture (2) Cloning and fermentation methods (3) Cell fusion (4) Embryo transfer (5) Recombinant DNA technology (Genetic engineering).

All these lead to hybrids with the purpose of creating High Yield Varieties.

## WHY DO FARMERS REJECT HIGH YIELD VARIETIES AND HYBRIDS?

Because they are (1) Susceptible to pests and diseases (2) They are not tasty (3) Straw yield is less (4) They are not higher yielding than native varieties (5) High yield varieties do not click with climate cycles. (6) Harvesting is labour intensive (7) They are expensive (8) Costs high.

## THE PRODUCER OF THE SEED

- a) The farmer has historically been the producer of seeds. They are perennial

- varieties which could reproduce themselves eternally.
- b) Government research institutions have produced seeds which are high yielding for short duration and then the yield reduces.
- c) Trans National Corporations produce nonrenewable and therefore non-

sustainable seeds, through hybrids and tissue culture. The farmer has to come to Trans National Corporation for seeds every time he has to sow.

The farmer owns the original seeds and the TNC's hybrids.

### COMPARISON OF LOCAL AND DOMINANT KNOWLEDGE SYSTEMS

| Local System (Diversified)   | Dominant System (Mono)   |
|--|--|
| 1. Forestry and agriculture integrated.  | 1. Forestry separate from agriculture.   |
| 2. Integrated systems have multi-dimensional outputs. Forests produce wood, food, fodder, water etc. Agriculture produces diversity of food crops. | 2. Each separate system made one dimensional. Forests produce only commercial wood. Agriculture produces only commercial crops with industrial inputs.       |
| 3. Productivity in local systems is a multidimensional measure, which has a conservation aspect.   | 3. Productivity is a one dimensional measure which is unrelated to conservation.   |
| 4. Increasing productivity in these knowledge systems involves increasing the multidimensional outputs, and strengthening the integration.         | 4. Increasing productivity in these knowledge systems involves increasing one dimensional output by breaking up integrations and displacing diverse outputs. |
| 5. Productivity based on conservation of diversity.  | 5. Productivity based on creation of monocultures and destruction of diversity.  |
| 6. Sustainable system.   | 6. Non-sustainable system.   |



Old lamps for new

## THE FARMERS' RIGHTS IN BIODIVERSITY CONSERVATION

- (1) The Right to own Biodiversity.
- (2) The Right to conserve, reproduce, modify, exchange, and sell seed and plant material.
- (3) The Right to land.
- (4) The Right to feed and save the country.
- (5) The Right to just agri-prices, public support and Sustainable Agriculture.
- (6) The Rights of information and participating research.

In traditional agriculture and forestry systems, biodiversity regenerates itself. It is both means of production and product. Thus the seed has been the source of grain as well as future source of seed.

Industrialised agriculture and seed industry with the help of Biotechnologies convert the seed into mere raw material for seed as commodity patented and privatised.

## CONSERVING BIODIVERSITY

There are two types of conservation (1) Farmbased type where farmer conserves by cultivation (2) Seeds and related materials are collected by non-farmers, and saved in genebanks (*Ex situ* conservation.)

Of these gene bank conservation has (i) scientific flaws (ii) technical inade-

quacy (iii) political inadequacy etc. *In situ* conservation is the only alternative. It takes care of food security, ecological aspects of adaptability and sustainability and the economic aspects of seed supply. But *in situ* conservation also throws up questions of (i) what to choose out of staggering variety? (2) can farmers be given incentives (3) organisation of seed supply route (4) the question of price support to the farmers (5) identifying and motivating scientists in conservation ecology, (6) sensitising the urban consumers who influence selection of varieties.

## TRADITIONAL AND NON-CHEMICAL METHODS OF INSECT CONTROL

The seeds are treated with one or more of the following to preserve them : (1) Black pepper (2) Cinnamon bark (3) Eucalyptus (4) Fenugreek (5) Vitex Negundo (6) Neem (7) Red Chillies (8) Mintleaves (9) Turmeric Rhizome (10) Wild Tobacco (11) Various plant extracts (12) Minerals like activated charcoal, fine sand, heat-activated clay dust (13) Ash of acacia, casuarina, cowdung, mango trees, rice husk, tamarind seeds etc. Drying in the sun, sieving, mixing with specific local plant produces, inert mineral dusts, storing in lofts above kitchen fire storing in airtight silos etc.

### THIRD WORLD NEEDS AND THE NEW BIOTECHNOLOGIES

| Basic Need   | Potential contribution of new biotechnologies   | Dominant research of biotech industry   |
|--|---|---|
| <p>Conservation and improvement of diverse poor people's crops emphasizing hardiness, nutrition, and yield.</p> <p><b>embryos</b></p> <p>Key concerns are durability, nutrition, and cost. Produce and production should be culturally and environmentally sensitive, making the best use of local resources.</p> <p>Conserve diversity and broaden breeding efforts for foraging animals to develop healthier, more efficient livestock. Develop multi-purpose domesticats.</p> | <p><b>CROP PRODUCTION</b></p> <p>Tissue culture technology could support conservation and breeding objectives.</p>                        | <p>Rather than pest resistance for pesticide the focus is on gene transfer for pesticide resistance, encapsulated and yield improvement for major crops only.</p>   |
|  | <p><b>FOOD PROCESSING</b></p> <p>Improvement of traditional fermentation methods and development of new possibilities.</p>                | <p>Focus is on reducing or substituting raw materials and the factory production of agricultural products.</p>  |
|  | <p><b>ANIMAL HUSBANDRY</b></p> <p>Vaccines and diagnostics can support these efforts and embryo transfer can help preserve diversity.</p> | <p>Attention is on complete control over fertility and reproduction to develop high yielding uniform, but highly vulnerable breeds and also on veterinarial packages and on use of livestock as bio-reactors for drugs.</p> |
| <p><i>Sustaining Diversity, Navdanya, New Delhi.</i></p>   |   |   |
|  |   |   |

## THREATS TO BIODIVERSITY

VANDANA SHIVA

### I. PRIMARY CAUSES

- a) Habitat destruction due to i) dams, ii) highways iii) mining in forests.
- b) Development projects in forest areas.
- c) Displacement of biodiversity by Monoculture.

### SECONDARY CAUSES

- a) Population.
- b) Unsettled communities in disharmony with nature.

### II. EFFECTS OF BIODIVERSITY EROSION

- a) Ecological vulnerability of monoculture of improved varieties.
- b) Social vulnerability of homogeneous systems the inter-related principle of diversity of the principle of symbiosis and reciprocity often also called the law of return.

### III. HOW TO PROTECT BIODIVERSITY

- a) Anticipate, prevent and attack the causes that reduce Biodiversity.
- b) Act quickly.
- c) Encourage *in situ* conservation.
- d) *Ex situ* conservation can be a secondary measure.

- e) Recognise the dependence of Biodiversity on the life style of the community that preserves it.
- f) Encourage the role of women.
- g) International local national cooperation.

### IV. WHAT IS IN SITU CONSERVATION?

- a) Establishing protected areas to conserve the endangered resource.
- b) Regulate their use.
- c) Promote protection of habitat.
- d) Promote environmentally sound development.
- e) Rehabilitate degraded systems.
- f) Study risks of Bio-technology-modified organism.
- g) Prevent threats.
- h) Promote compatibility between present use and sustainability.
- i) Provide administrative, financial and legal support.

### V. EX SITU CONSERVATION

- a) Site as near as *insitu* as possible.
- b) Maintain facilities that resemble *in situ* situation.
- c) Plan for reintroduction into *in situ* area.

***From: Monocultures of the Mind.***

## BIOTECHNOLOGY AND THE ENVIRONMENT

The fact that one of the Agenda items for the UN Conference on Environment and Development (UNCED) is the 'environmentally sound management of biotechnology' indicates that biotechnology is surrounded by social and ecological anxiety.

The first anxiety arises from the fact that the new biotechnologies tamper with the very fabric of life, and demand a fundamental restructuring of our minds, our ethics, our environmental, social and economic values and relationships. While biotechnology in its broadest sense is a very ancient group of technologies, it is the new biologies which generate new social, ecological, economic and political risks. The new biotechnologies consist of two major groups of technologies.

The first group, 'genetic engineering' refers to the new techniques deriving from advances in molecular biology, biochemistry and genetics. The second group is based on new cellular procedures based on the older technology of tissue culture.

Genetic engineering is a very powerful technique which theoretically allows any gene to be moved from any organism into another. Recombinant DNA technology has the potential to transform the genes into a global



resource that can be used to shape novel life forms. It is this technical power which gives it the potential to become more pervasive than any technology in the past.

The new biotechnology has already found applications in primary industries (agriculture, forestry and mining), in secondary industries (chemicals, drugs, food) and in tertiary industries (health care, education, research, advisory services).

In addition to the wide ranging applications of biotechnology is the fact that the development of the new technologies is nearly entirely controlled by transnational enterprises, though universities and small firms evolved the techniques. These corporations are diversifying into every field of speciality which uses living organisms as a means of production. Traditional industry sectors are becoming less distinct and corporate boundaries virtually unlimited (Fowler et.al, 1988). This integration, centralisation and control carries with it an inherent destabilisation at the social, economic and ecological levels.

*- Vandana Shiva*

## **THE BIODIVERSITY BILL : A FRAUD ON THE NATION**

**Dr. VANDANA SHIVA**

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**O**ver the last eight years, the environmental community in India has worked to strengthen the biodiversity rights of the people and implement the Convention on Biological Diversity (CBD), which, in spite of all its flaws has tremendous potential for being an instrument of ecological sustainability and social justice.

While the Fifth Conference of Parties of the CBD meets in Nairobi, the Government of India tabled a Biological Diversity Bill, 2000. I was a member of the expert group that drafted the Bill. The Draft, as agreed to by me, was even used by the Attorney General in the Supreme Court to give an assurance to protect in case of failure of the government to protect our biodiversity and prevent Biopiracy.

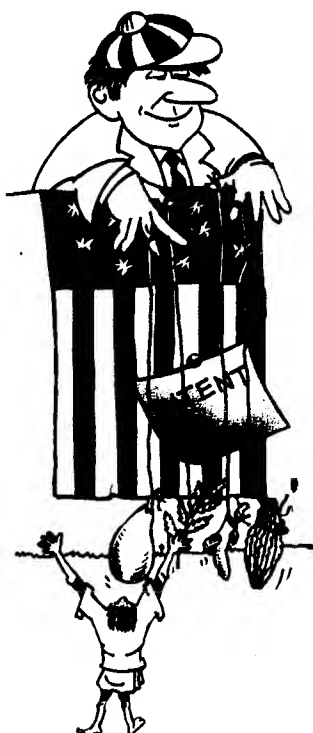
However, the Bill tabled in Parliament is not the draft the expert committee cleared. The draft we cleared was aimed at conserving biodiversity and protecting people's sovereign rights to these resources and knowledge.

The draft brought to the Parliament

negates these objectives and has shaped a law for the appropriation of people's resources and knowledge by corporation with the approval of the Government. Several changes have been introduced in crucial areas from the version drafted by the expert group of which I was a member. The deletion of key articles, and the addition of phrases has changed the draft significantly. The Bill is totally antithetical to the draft we had prepared. It is now a bill to regulate access to biodiversity, not a bill to ensure its conservation or the protection of people's rights.

A key change that has been made is to transform the Biodiversity Bill from being a bill to prevent the patenting of indigenous knowledge and biodiversity to being a bill to promote such patents through the clearance of the National Biodiversity Authority. In the earlier draft we had prepared we had identified one of the functions of the National Biodiversity Authority as 8 (iv) Setting up mechanisms to monitor, and where necessary, advise regarding all steps necessary to oppose grant of intellectual property protection on biological resource and associated





knowledge obtained from India.

This has been replaced by:

6 (1) No person shall apply for any intellectual property right by whatever name called in or outside India for any invention based on any research or information on a biological resource obtained from India without obtaining the previous approval of the National Biodiversity Authority before making such application:

This is not an end to Biopiracy. It is Biopiracy approved by the National Biodiversity Authority.

In the area of agricultural Biodiversity the Bill in fact states that the IPR's can be granted without the approval of the Authority Art. 6 (3) states :

The provisions of this section shall not apply to any person making an application for any rights under any law relating to protection of plant varieties enacted by Parliament.

This implies that the global seed industry can freely take seeds, claim patents or breeder's rights by tinkering with them, and not be regulated to restrict Biopiracy as in the case of neem or basmati or monopolies in seed supply.

This is specially ironic given the fact that we have the neem patent revoked in the European patent while the phenomenon of Biopiracy is legally recognised in Europe. Not only does the Biodiversity fail to prevent such Biopiracy, it has through Art. 6 (3) legalised it for crops and seeds.

While the global seed and biotech industry are being left totally unregulated by the present Bill, the Indian people's access to their own resources is being regulated.

Article 7, which was not in our draft, has been added and it states:

No person who is a citizen of India



or a body corporate, association or organisation which is registered in India shall obtain any biological resource for commercial utilisation or bio-survey and bio-utilisation except after giving prior intimation to the State Biodiversity Board concerned:

This Bill is thus the modern day equivalent of the colonial Forest Act which gave access to India's forests to timber merchants but denied access to local communities whose forests the British empire usurped.

The most important aspect of the CBD is the conservation and protection of Biodiversity by ensuring Biosafety. Article 19.3 of CBD is the basis of the Biosafety Protocol which was finalised in Jan 2000 in Montreal and is up for signature at COP V. In addition, Art. 14 is aimed to prevent adverse impacts on Biodiversity. Our draft has a section 13 on Minimising Adverse Impacts on Biodiversity, which states:

(i) Measures shall be undertaken for environmental impact assessment of proposed projects that are likely to have adverse effects on biological diversity with a view to avoiding or minimizing such effects and, where appropriate, allow for public participation in such procedures.

(ii) Measures shall be undertaken to regulate, manage, or control the risks

associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental impacts that could affect the conservation and sustainable use of biological diversity, taking also into accounts to human health.

This section has disappeared in the draft submitted to the Parliament. The Biodiversity Conservation has therefore been undermined and large scale economic activity has been left totally free to continue to destroy our biological diversity and push species to extinction. The genetic engineering industry has been left free to unleash biohazards.

The present Biological Diversity Bill is in fact a bill to protect corporate monopolies on life forms through intellectual property rights and protect corporate polluters from paying for the genetic pollution and biological destruction they cause. This is not the spirit of the CBD. It was not the substance of our draft.



The Biological Diversity Bill is a fraud on the nation. It must be rejected.

The Biodiversity Bill is a fraud on the Nation. It must be rejected.

## AN APPROACH TO ASSESSING PROGRAM TOWARDS SUSTAINABILITY - IUCN

### QUESTIONS OF SURVIVAL

Questions environmental workers have to ask.

#### I. Identity - Who are we?

Purpose - Why are we here?

Responsibility - Are we being true to ourselves?

#### II. In what way is your Environment changing?

What changes?

How do we recognize change?

What are our indicators that relate cause to effect?

What indications work at grassroots?

#### III Problems

What problems have resulted from the changes?

And which have always been there?

What benefits—what costs?

What will happen if we continue with the present Environmental habits?

What will happen if we stop them?

#### IV Victim

How is your Environment being affected

by others in ways which seem out of your control?

Who causes damages - why?

What benefits do they get by damaging the Environment?

Are we also benefiting from the damage?

Benefit/Cost Balance

Is the situation out of control? How to get back control?

#### V Culprit

To what extent our day-to-day actions consume nonrenewable resources?

Are we replacing the resources?

Do we pollute directly/indirectly?

How can be change?

How should others change?

#### VI Knowledge

Who at the grass root level has expert knowledge?

Academic institutions—which?

Who else?

What are our basic questions, urgently needing answers?

#### VII Community

Who else is threatened by the same problem?

Whose experience is useful to us?

Which actions are possible for groups, not possible for individuals?

### **VIII Values**

Who/what is your model?

What do you need before you say 'enough'?

What will be the local/global effect if every one has the same model as you have?

Compare what you need with what you lose.

What values are implicit in your current institution/family, school?

What offends you most? What is your scale of values in terms of good/bad.

### **IX The chain of influence**

|                 |          |             |          |            |          |              |
|-----------------|----------|-------------|----------|------------|----------|--------------|
|                 | analysis | problematic | analysis | motivating | analysis | Design       |
| The environment | impact   | human       | impact   | values and | impact   | intervention |
|                 |          | behaviour   |          | the power  |          | action       |
|                 |          |             |          | to act     |          |              |

Problems of human behaviour—ignorance, desperation, greed.

### **ASSESSING RURAL SUSTAINABILITY**

|                 |                     |
|-----------------|---------------------|
| Eco subsystem   | Naturalness         |
|                 | Degradation         |
|                 | Biodiversity        |
| Human subsystem | Economic production |
|                 | Values              |
|                 | Attitudes           |
|                 | Organization        |
|                 | Power               |

Is Indicator subjective/objective?

### **BAROMETER OF SUSTAINABILITY**

| <b>ISSUE</b>                  | <b>INDICATOR</b>                            |
|-------------------------------|---|
| Ecosystem, Land quality/land. | Degraded land as a percentage of total.     |
| Degradation.                  |   |
| Pressure on water supply.     | Water withdrawal as a percentage of supply. |

|                     |  |
|---------------------|--|
| Greenhouse gases    | CO <sub>2</sub> emission per person.                 |
| Species Diversity   | threatened species as a percentage of total species. |
| Pressure on forests | Annual change in forest area.                        |

### PEOPLE

|                                 |   |
|---------------------------------|---|
| Health                          | Life expectancy and birth.                    |
| Literacy                        | Children reaching grade 5.                    |
| Income                          | Real gross domestic product prepare per year. |
| Personal security, civil order, | Violent crime rate per 1 lakh population.     |
| Gender equality, education.     | Ratio in scheme.                              |

### CONSOLIDATION OF INFORMATION

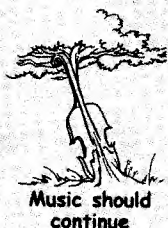
#### Ecosystem well being

Climate  
Forest lands  
Grazing lands  
Croplands  
Rivers/wet lands  
Other eco components

#### Human well-being

Food  
Income  
Wealth/infrastructure  
Health/population  
Knowledge  
Institutions

### BIODIVERSITY AND SUSTAINABILITY OF AGRICULTURAL SYSTEM



*As with any ecosystem the functioning and sustainability of agricultural systems depend greatly on biological diversity. It has been demonstrated that more diverse plant communities use and retain nutrients more efficiently thereby attaining greater productivity and reducing nutrient-leaching losses from the ecosystem. Various soil microbes also effectively recycle nutrients. Earthworms, insects, and fungi all play a vital role.*

*Biological diversity also enhances natural pest control mechanisms in agroecosystems. In fact every species that exists in agroecosystems has intrinsic value. Insects provide a virtually untapped source of food, dyes, and pharmaceutical products. Elimination or addition of even one species can have profound effects. A remarkable example illustrates this. Until a few years ago pollination of oil-palm trees in Malaysia was done manually - an inefficient and expensive way of performing the task. Ten years ago the government introduced a tiny weevil from West Africa's forests associated with palm pollination. The pollination of palm trees in Malaysia is now entirely accomplished by the weevil, lending to annual savings of \$140 million.*

*- Jitendra P. Srivastava et al*

## POINTS TO PONDER



Listen

★ To increase yield per unit area, it was imperative to grow high yielding crop varieties which enabled the launching of the green revolution in some of the major food crops like wheat and rice. Ironically, many of the high yielding varieties are prone to attack by a number of pests and diseases which hamper the overall production markedly.

More than 20,000 species of pests destroy a third of the world's food production annually and these losses amount to one billion dollars. To combat these losses, high yielding crop varieties with resistance to pests and diseases have to be evolved.

★ Use of plants with genetic resistance to pests and diseases is a control tactic that is relatively stable, cheap, non-polluting and generally compatible with other tactics of pests suppression. In many food crops, resistant varieties have been developed, which were bred by crossing high yielding susceptible cultivars with resistant accessions or donors. The resistant donors are identified by screening of the germplasm materials available in the respective crops.

★ Various strategies, such as increasing the genetic base of resistance, developing horizontal resistance, use of wild relatives for infusing resistance and genetic engineering can be effectively used to achieve environmentally sound disease and pest control. Resistant varieties form the basic component of an integrated pest management programme, to which many of the other methods can be complementarily integrated.

★ For an effective and economical protection against insect pests there is no substitute to host plant resistance. With the reduction of genetic variability in the primary gene pool, it is becoming important to look for useful genes beyond the traditional sources. These sources include the wild and weedy relatives of cultivated rice. There is an urgent need to collect, characterise and conserve them. Cellular and molecular techniques offer a wide range of novel means to enrich the rice gene pool. The genetic variability from both conventional and non-conventional sources should be deployed suitably for economically and ecologically sustainable rice farming.

★ While the food security of India has been ensured through the Green Revolution, the nutritional security remains an unfulfilled goal, with only

40% of the per capita requirement of 400g of fruits and vegetables being available. The area and production under fruits are 2.9 million hectares and 26.5m tonnes, respectively, and under vegetables 4.3m hectares and 48.5m tonnes. To meet the ideal dietary requirement, the minimum production is estimated to be 91m tonnes.

★ Indian agriculture has had a long history of emphasis on 'food' crops (grains), the awakening to horticultural

possibilities being comparatively recent. The greater economic benefits from horticultural crops, particularly to poor and marginal farmers, constituting 90% of the 100 million operational holdings, has been a driving force in favour of horticultural crops. Besides there are other negative factors against cereal crops, notably recurrent drought, dwindling water resources, labour scarcity and low levels of profit.

*Source: Biodiversity by  
M.S. Swaminathan and S. Jana.*



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## **ABOUT VIVEKANANDA KENDRA**

Swami Vivekananda, with intense love in his heart for the motherland, undertook wanderings all over India. He came to Kanyakumari and sat on 25th, 26th and 27th December 1892 on the mid-sea rock meditating on India's past, present and future.

It was on this rock that he discovered the mission for a glorious India and later shook the world by his talks on India's spirituality. On this sanctified place the Late Mananeeya Eknathji Ranade, with the participation of millions of people of India, constructed the Vivekananda Rock Memorial, which symbolizes the glorious mission of India as seen by Swami Vivekananda in his meditation. Millions of people visit this monument and the two permanent Exhibitions - "Arise, Awake" and "The Wandering Monk" - based on the Life and Message of Swami Vivekananda, at Kanyakumari, and get inspired to work for the nation.

Along with this Memorial, Shri Eknathji Ranade founded the Vivekananda Kendra, a spiritually oriented service mission which reflects Swami Vivekananda's vision of a glorious India in action. The Vivekananda Kendra calls upon those youth who can dedicate their life for serving the nation.

For actualizing this vision, the Kendra has 124 branch centres spread over 17 States of India to work for all strata of the society to rebuild the nation. To achieve this, Life Workers, Whole-time Workers and the local workers of the Kendra carry out various service activities through Yoga, Rural Development, Education, Development of Natural Resources, Organizing Youth and Women, and Publications based on the life and message of Swami Vivekananda. The Kendra urges all to join in this task of national regeneration.